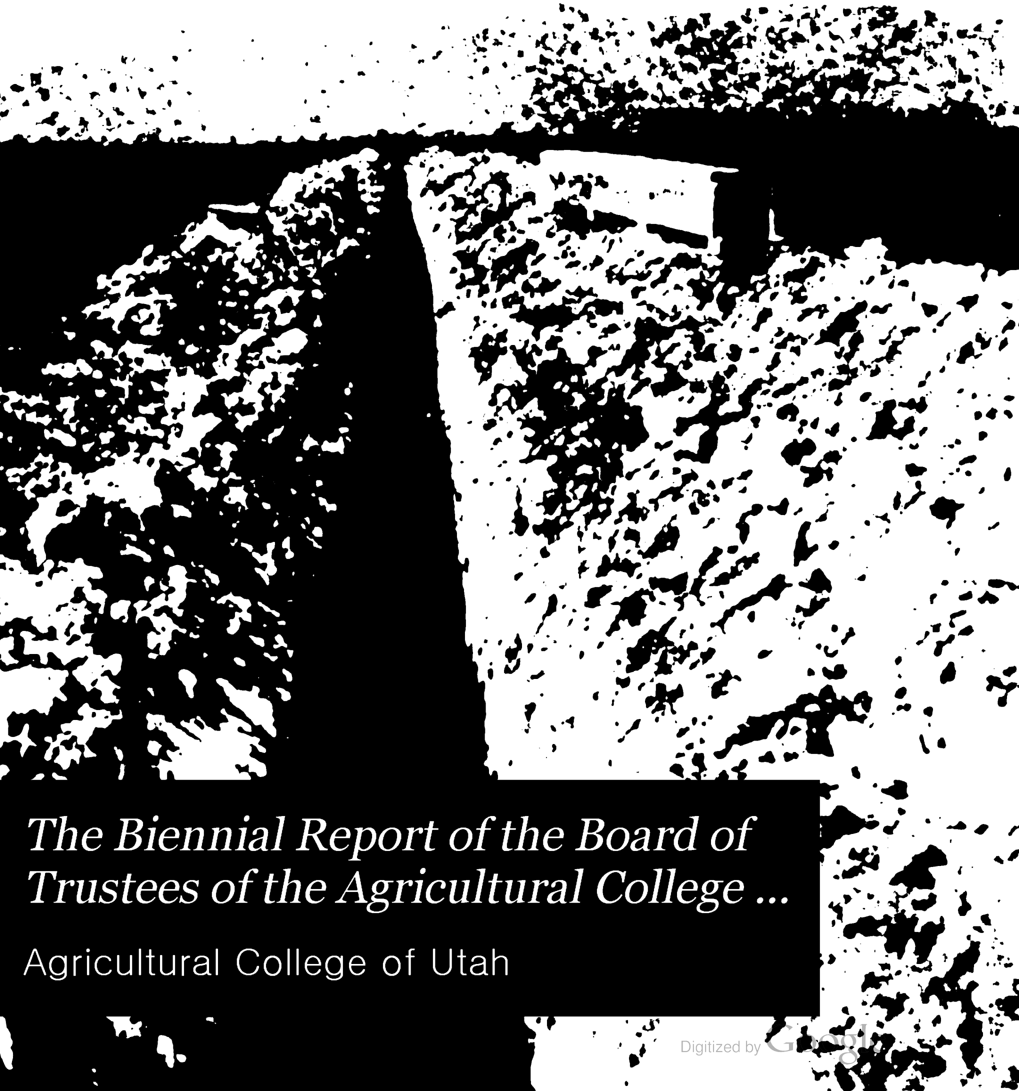
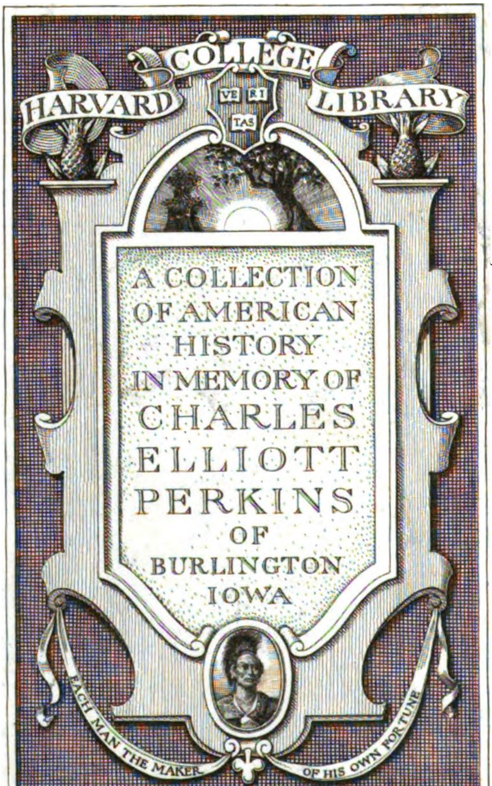


The Biennial Report of the Board of Trustees of the Agricultural College ...

Agricultural College of Utah


HARVARD COLLEGE LIBRARY
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A COLLECTION OF AMERICAN HISTORY IN MEMORY OF CHARLES ELLIOTT PERKINS OF BURLINGTON IOWA
EACH MAN THE MAKER OF HIS OWN FORTUNE
Bruce Rogers Del.

THE BIENNIAL REPORT

OF THE

BOARD OF TRUSTEES

OF THE

Agricultural College of Utah

For the Years 1905, 1906.

Accompanied by

The Report of the President, and the Secretary's Report of the Receipts and Disbursements.

SALT LAKE CITY
THE DESERET NEWS
1907

THE BIENNIAL REPORT OF THE BOARD OF TRUSTEES

OF THE

Agricultural College of Utah,

For the Years 1905 and 1906.

To the Governor and Legislative Assembly of Utah:

The Board of Trustees of the Agricultural College of Utah respectfully submits its biennial report.

The report of the President of the College, with the appended department and statistical reports, and the report of the Secretary of the Board of Trustees of the receipts and expenditures for the past two years and the inventory of the College property, are hereby submitted and made a part of this report. In these reports will be found detailed information regarding the condition of the College, and the estimates of the requirements of the institution for the biennium beginning July 1, 1907.

Fire in Mechanic Arts Buildings.

We regret to have to report that on September 11, 1905, just one week before the College was to open for the work of the year, a great disaster befell the institution in the destruction by fire of the Mechanic Arts buildings and equipment. Immediately after the fire, arrangements were made to have the insurance adjusted, the debris cleared away, and estimates prepared by architects and the Director of the Department of Mechanic Arts of the amounts that would be required to restore the buildings and equipment. At a meeting of the Board of Trustees, held on September 26, 1905, various matters relating to the fire and the necessity of the immediate restoration of the buildings and equipment were carefully considered. A resolution was adopted submitting the following petition to the State Board of Examiners:

"Salt Lake City, Utah, Sept. 20, 1905.

Governor John C. Cutler,
Chairman Utah State Board of Examiners,
Salt Lake City, Utah.

Dear Sir:—We, the Trustees of the Agricultural College of Utah, respectfully report that during the night of September 11th, a fire occurred in the buildings used for the work in Mechanic Arts, resulting in the total destruction of the storage building, and of a large part of the other buildings used by the different departments of Mechanic Arts, all of the latter being destroyed except some of the walls. The equipment and supplies on hand at the time of the fire were almost completely destroyed. According to the most conservative estimate of the Architects, $15,388 will be required in restoring the buildings. This amount, however, contemplates that cement floors shall be used in the forge room and in the machine rooms, and that brick instead of lumber shall be used in the walls of the storage room. An inventory of the equipment and supplies destroyed, compared with present prices, shows that at least $18,000 will be required to replace the equipment and supplies needed in continuing the work of the department, making the total amount required, $33,388. The buildings and equipment were insured for $7,100, leaving a net balance of $26,288. We respectfully petition your Honorable Body to authorize us to incur a deficit in this amount.

Petition to State Board of Examiners.

Assuring you of our profound regret that such a disaster should have befallen us, and of our sincere aopreciation of any assistance you may render in the emergency occasioned thereby, we are,

Most respectfully yours,

....

....

Trustees Agricultural College of Utah."

This petition was presented by the Board of Trustees to the State Board of Examiners at a meeting held in the Office of the Governor on the afternoon of September 20, and explanations were offered as to the importance of immediate action in providing for the restoration of the property destroyed, in order that there might be as little interference as possible with the work of the institution.

It is a great pleasure to report that the State Board of Examiners gave the petition immediate consideration, and authorized and empowered the Board of Trustees to create a deficit to the amount of $26,288 for the purposes indicated in the petition.

As soon as plans and specifications could be prepared, bids were advertised for in accordance with the provisions of law, and at a meeting of the Board of Trustees, held on October 3, 1905, bids were received and contracts were awarded for the mason work, carpentry work, cement work, and painting.

Great difficulty was encountered in securing the necessary tools and machinery, on account of the inability of the manufacturers to fill orders promptly. After extended negotiations, however, and explanations of the great interests involved, the manufacturers gave precedence to the orders from the College, and most of the equipment was finally secured in time for installation when the buildings were sufficiently completed for occupancy. Special prices were also received on account of the disaster, and the aggregate cost of the equipment was thereby considerably reduced.

Equipment Secured.

At the time the architects prepared their preliminary estimates of the cost of reconstructing the buildings, it was thought that most of the walls remaining after the fire could be saved. After the debris had been cleared away, however, and a more careful examination was made, it was discovered that the damage was much greater than was originally thought, and it became necessary to remove all of the walls and about one foot of the foundation of the entire front of the building; also several feet from the top of the walls of the foundry, and the carriage and forge shops. It was therefore found impossible to keep the cost of the building within the amounts originally estimated.

Cost Exceeded Estimates.

It was deemed advisable while rebuilding to take advantage of the opportunity to make such improvements as could be made without much additional cost, with the result that the new building is an improvement in some important respects over the old one.

Buildings Improved.

On account of the difficulties encountered by the contractors in securing workmen, and the inclemency of the weather early in the season, there were unavoidable delays

in completing the building, so that all of the departments were not able to resume their work until near the close of the school year. Some minor details in restoring the cupola of the foundry and the equipment of the blue printing rooms, etc., were not finally completed until November of the present year.

As shown in the report of the Secretary, the cost of reconstructing the buildings was $22,900.11, and of restoring the equipment, $16,921.46, making a total of $39,821.57. The Secretary reports that from the salvage and donations made by the architects and contractors $500.32 was received, leaving a balance of $39,321.25. The available funds were as follows:

Authorized deficit	$26,288.00	
Insurance	7,100.00	
Donations and receipts from salvage.	500.32—	$33,888.32
Total cost of restoration		39,821.57
Balance		$ 5,933.25

This amount of $5,933.25 was provided for from the general maintenance fund. While it was necessary to delay some other needed improvements in order to meet this expenditure, it was decided, after considering all of the interests involved, that this plan was the best under the circumstances.

Department Assisted.

In this connection your attention is called to the great assistance rendered by the employees and advanced students of the Mechanic Arts Department in the completion of the buildings, and in the restoration and installation of the equipment. A detailed statement of this work is given in the report of Director Jenson.

Origin of Fire.

Soon after the fire occurred, the Board of Trustees appointed a committee, consisting of Trustees J. A. McAlister, Evan R. Owen, and Thomas Smart, to make a thorough investigation of all matters relating to or connected with this disaster. The committee in its investigations interviewed different people who witnessed the conflagration, as well as persons who had been around the buildings during the preceding day, but they were unable to determine how the fire originated.

In an appended report will be found a detailed statement

of the insurance carried on the property of the College, giving the names of all the companies with which insurance is carried, the amount and date of expiration of each policy, and the amount of premium. The following is a summary, showing the total insurance carried on each building:

Insurance on Buildings.

	Total Insurance.	Total Premium.
Main Building and equipment	$131,000	$1,653.65
Mechanic Arts Building	15,000	180.00
Dormitory	5,000	67.50
Cattle Barn	5,600	126.00
Poultry House	2,500	37.50
Sheep barn	2,400	54.00
Horse barn and equipment	5,100	65.72
Piggery	1,000	15.00
President's residence	3,000	38.66
Directors' residence	2,800	39.26
Agronomist's residence	1,200	14.70
Three laborers' cottages	1,200	15.46
Residences on Southern Experiment Sta.	2,100	41.50
Total	$177,900	$2,348.95

As shown in the report of the Secretary the College has property as follows:

Value of Property.

Land	$ 23,200.00	
Buildings	295,663.99	
Total equipment, exclusive of the Southern, Central and Arid Experimental Farms	100,930,52—	$419,794.51
According to the report of the Secretary of the State Board of Land Commissioners, Dec. 17, 1906, the value of the Agricultural College lands amounts to		183,442.77
This amount added to the value of the College property, as given in the inventory, makes the total value of the College plant, including endowment		$603,237.28

The Agricultural College receives appropriations from the Federal Government under three Acts of Congress. The Act approved in 1887, known as the Hatch Act, appropriates $15,000 annually for the Experiment Station,

Hatch Act.

"In order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science," etc.

The Act of 1890 appropriates $25,000 annually, with the provision that it shall—

Morrill Act.

"Be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction."

The Act of 1906, known as the Adams Act, provides an appropriation—

The Adams Act.

"For the more complete endowment and maintenance of agricultural experiment stations now established or which may hereafter be established in accordance with the Act of Congress approved March second, eighteen hundred and eighty-seven, the sum of five thousand dollars in addition to the sum named in said Act for the year ending June thirtieth, nineteen hundred and six, and an annual increase of the amount of such appropriation thereafter for five years by an additional sum of two thousand dollars over the preceding year, and the annual amount to be paid thereafter to each state and territory shall be thirty thousand dollars, to be aplied only to paying the necessary expenses of conducting original researches or experiments bearing directly on the agricultural industry of the United States, having due regard to the varing conditions and needs of the respective States or Territories."

This Act further provides, that—

"The grants of money authorized by this Act are made subject to legislative assent of the several States and Territories to the purpose of said grants: Provided, That payment of such installments of the appropriation herein made as shall become due to any state or territory before the adjournment of the regular session of the legislature meeting next after the passage of this Act shall be made upon the assent of the governor thereof, duly certified by the Secretary of the Treasury."

And again, that—

"No portion of said moneys exceeding five per centum of each annual appropriation shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building or buildings, or to the purchase or rental of land."

None of the appropriations to the Experiment Station, under the Acts of 1887 and 1906, can be used in any way whatever for the expenses of the College for instructional purposes, and these amounts, therefore, cannot be considered in estimating the requirements of the College for the educational work of the different departments. Only the $25,000 received annually under the Morrill Act of 1890 can be applied to instruction.

Special attention is called to the necessity of the State Legislature at its next session passing a law assenting to the purpose of the Adams Act in conformity with the requirements of Congress.

Estimates Conservative.

The estimates of the requirements of the College for the next biennium have been prepared with great care, with the view of making the appropriations asked for as low as possible, consistent with efficient work. It is not thought, however, that it would be wise economy, in the interests of the College or of the State, to place the estimates lower than required to do successfully the work which is undertaken, and to keep the buildings and other property in good repair.

No appropriations are asked for for buildings during the next biennium, but it is very important that certain miscellaneous improvements be made, as explained in the appended

reports. The large increase in the amount of work called for in the different departments of agriculture, and the enlargement of the agricultural faculty, as explained in the President's Report, make it necessary to provide additional room for this work. By finishing the rooms in the attic story in the front of the main building, the work in drawing and in English can be readjusted so as to provide additional rooms on the first floor for the departments of agriculture.

More Room for Agriculture.

REQUIREMENTS.

The estimated requirements from the State Legislature for the next biennium are as follows:

Salaries on the basis of the budget for the present year	$63,500	
For two years		$127,000
Additional assistants and instructors required for the work in Animal Husbandry, Botany, Dairying, Zoology and Entomology, etc.	5,685	
For two years		11,730
Total salaries for two years		$138,730
Miscellaneous expenses for fuel, electric light and power, janitorial services, firemen, night watchmen, printing, insurance, etc.		34,500
Supplies and labor, including department and miscellaneous supplies, feed for live stock, milk for creamery, etc., less estimated income from sales		19,950
Repairs, including general repairs on buildings, painting, sewerage, water works, steam heating, etc.		7,505
Equipment required for the different departments, given in detail in the appended reports, with such reductions as the Board thinks it possible to make without seriously impairing the efficiency of the work		18,676
Total		219,361

Less income for two years:

Federal Government, Morrill Act...	50,000	
Estimated interest on land-grant fund	18,000	
Fees	10,000—	78,000
Balance		$141,361
Miscellaneous improvements, including extension of water pipes, addition to smokestack, boiler for the Dormitory, sewerage system, etc..............	6,235	
Livestock, including pure-bred mares, dairy cattle, beef cattle, hogs, and sheep....	5,720—	11,955
Total amount required from Legislature..		$153,316

Irrigation Engineering.

Particular attention is directed to the arguments in the accompanying reports on the interdependence of agricultural and engineering courses, and the importance, in the development of the State, of having the work in agriculture and certain lines of engineering associated in the same institution. In connection with the recommendations of the President, the Board of Trustees urge the importance of providing for a course at the College in irrigation engineering. Estimates of the cost of the work have been carefully prepared, and it is shown that the total additional expense to the State would be $4,600 for the biennium.

Good work Accomplished.

In conclusion, it is a great pleasure to report that a spirit of harmony and co-operation prevails among the faculty, and that excellent work is being accomplished throughout the different departments of the institution. Especially commendable has been the progress made in the technical courses, particularly in agriculture. The number of students registering for this work has rapidly increased, the agricultural faculty has been enlarged and strengthened, and the standard of efficiency has been advanced.

The Agricultural College of Utah has grown during recent years until it has attained a position of honor and credit among the agricultural colleges of the country. Through the

work it is accomplishing along the various lines of agriculture, commerce, mechanic arts, and domestic science and arts, this institution has become a potent factor in developing the State's industries and resources.

Respectfully submitted,

W. S. McCORNICK,

President Board of Trustees,

Agricultural College of Utah.

December 28, 1906.

President's Biennial Report.

AGRICULTURAL COLLEGE OF UTAH.

1905 and 1906.

To the Board of Trustees of the Agricultural College:

The President of the College has the honor to submit the following report for the past two years, together with an estimate of the requirements of the institution for the biennium beginning July 1, 1907. For a more detailed statement of the condition of the College and of its needs, your attention is respectfully invited to the appended reports and official College publications, which are submitted as a part of this report. The appendices include:

1. Reports of Departments of Instruction.
2. The Report of the Librarian.
3. The Report of the Registrar.
4. The Report of the Director of the Experiment Station.
5. The Report of Farmers' Institutes.
6. The Report of the Superintendent of Buildings.
7. Itemized Estimates of Requirements.
8. A report of the Insurance on Buildings and Equipment.
9. The Annual Reports of the Experiment Station for the past two years.
10. The Farmers' Institute Annuals, Numbers Eight and Nine.
11. The Report of the Southern Experiment Station.
12. The Report of the Central Experiment Station.
13. The Report of the "Experimental Farms on Arid Lands."
14. The Report of the "Irrigation and Drainage Investigations.
15. A Copy of the College Catalogue for 1906-7.

In the Prseident's Report for 1901-1902, the function and field of the land-grant colleges of the United States were discussed at some length. Excerpts from the laws under which these institutions are maintained, and the interpretation thereof by the Department of the Interior, were given and statistics were quoted, indicating the purpose in view in the establishment of these institutions, and the policy which has been pursued in their development. The work of the Agricultural College of Utah was outlined; and the scope and policy of this institution, consistent with the obligations of its environment and the means available for its support, were shown to be in harmony with the spirit and policy of the best agricultural colleges of the country.

Report for 1901-1902.

In the report for the succeeding biennium, statistics were given showing the remarkable relative growth of the technical courses distinctive of the College, particularly along the different lines of agriculture, and clearly indicating the directions in which the institution is developing. It was shown that there was a large increase each year in the percentage of intrants who were registering for the regular technical courses, with a relative decrease in the number of students coming to the institution for the general and preparatory work. The standard of work was shown to compare favorably with that of similar institutions. The organization and courses of the different schools and departments, together with the sources of income and the relation of the College to the Federal Government and to the State, were fully explained.

Report for 1903-1904.

It is not thought necessary, therefore, in this report, to enter upon a lengthy discussion of these questions. However, in contemplating the position which the Agricultural College of Utah has achieved among the best land-grant institutions, and the recognition given to its work by leading colleges and universities, it may not be inappropriate to pause long enough in retrospect to record the obligation which the State is under to those who organized the institution and outlined its first courses of instruction. Their interpretation of the Federal and State laws, and their conception of the purpose in view in the establishment of land-grant colleges, were so broad and comprehensive that throughout the development of the institution to the present time there has been no de-

Plan of College Organization.

parture from the general plan formulated at the beginning. Furthermore, this plan has made the Agricultural College of Utah, though one of the youngest land-grant institutions of the country, a pioneer in some important features of industrial education among like institutions, established more than a quarter of a century before, in many of the larger and wealthier states.

Great credit is due to President Sanborn under whose administration the plans were formulated for the development of the College upon a foundation sufficiently broad to meet the varied and peculiar needs of a young but rapidly growing commonwealth; and to the trustees, who, during the formative and therefore most important period of the institution's growth, have pursued with unselfish devotion a policy at once conservative and progressive in meeting the exigencies of the present and in anticipating the demands of the future. To President McCornick, particularly, does the State owe a debt of gratitude for his having served the interests of the College, as President of the Board of Trustees for more than sixteen years, with such rare tact, wise judgment, unceasing fidelity, and sound business-like conservatism.

Credit Due President Sanborn, Trustees, President McCornick.

STUDENTS.

As shown in the Report of the Registrar, the enrollment in all the courses of the College for the year 1904-1905 was 733, representing twenty-four different counties of Utah, fourteen different states, and two foreign countries. For the year 1905-1906, 663 students were registered from twenty-four different counties of Utah, eleven different states, and three foreign countries. The smaller attendance during 1905-1906, may be attributed to two things, which are discussed at length in another part of this Report; first, the passage by the State Legislature at its last session of a law prohibiting the College from offering courses in engineering; and second, the destruction by fire of the Mechanic Arts buildings and equipment just a week before the opening of the College in September.

Enrollment Distribution.

The registration for 1906-1907 is incomplete, but indicates a total attendance for the year of about 750, the highest mark the student roll has reached. The loss of last year, there-

fore, will have been recovered before the end of the biennium. Besides, on account of the abandonment of the Sub-Preparatory course, about forty students have been denied admission this year. Except for the disasters, referred to above, which have befallen the institution during the last two years, the normal increase in attendance, as shown by the average increase during the preceding five years, would have brought the registration for the present year to upwards of 1,000 (1,023).

Vocations Represented.

A table has been prepared giving the vocations represented by the students. The occupations of the students' parents and guardians are shown by this table to be about the same as they were two years ago, as printed in the last biennial report, except that the proportion of students who are from the homes of farmers and dairymen has increased from 53.71 per cent to 57.23 per cent.

Age of Students.

The ages of the students range from fourteen to fifty-six, most of them being between sixteen and twenty-three. The average age for 1904-1905 was 19.45; for 1905-1906, 19.97. The ages of the students who have already registered this year range from fourteen to forty-seven, the average age being 19.74. Of the students registered in 1904-1905, 539 were men and 194 were women; in 1905-1906, 463 were men and 200 were women.

Enrollment.

The following table gives, for each of the past six years, the total registration and the number of students in each of the several courses:

Year	Agriculture	Domestic Science	Commerce	Engineering and Mechanic Arts	General Science	Preparatory	Special	Summer School	Total
1900—1901	17	57	44	74	14	160	14		380
1901—1902	23	82	109	111	14	169	8		516
1902—1903	47	116	104	112	14	136	16		545
1903—1904	74	134	100	160	17	138	27	36	623*
1904—1905	115	131	142	168	21	131	8	21	733*
1905—1906	108	113	127	136	30	97	20	36	663*

*These totals represent the number of different students registered during the year, the names of regular students who also attended the Summer School having been deducted.

In the Registrar's report for the preceding biennium is given a table showing the registration by courses for each year since 1892-1893. While the total enrollment has increased since that date from 367 to 733, there has been a decrease in the number of students in the preparatory work from 208 to 97. The greatest improvement in this particular has been since 1899-1900, the drop from that year to 1905-1906 being from 249 to 97, or a decrease of 156.7 per cent. During the same period the increase in the total attendance was about fifty per cent.

Significance of Table.

Two hundred and eleven students have been graduated from the different courses of the institution, and nearly nine thousand have attended for a longer or shorter period. The graduates have been successful to an unusual extent. They are found in positions of prominence and responsibility in the various departments of industrial activity, and are becoming a potent factor in the development of the resources and industries of the intermountain country. Furthermore, thousands of young men and women throughout Utah and adjoining states, who have been unable to continue their courses to completion, have received training at the College which has opened up to them careers of happiness and profit to themselves and of the highest usefulness to the communities in which they live.

Graduates.

FACULTY.

During the year 1905-1906, the faculty consisted of forty-nine members, besides the administrative officers, and five instructors in music who had private work only and received no compensation from the College. This number does not include members of the Experiment Station Staff who had no work of instruction. There were twelve professors, nine assistant professors, eighteen instructors, and ten assistants. The time of five professors and three asistant professors was divided between the work of instruction and of the Experiment Station. Five instructors were pursuing courses as students, and devoted only part of their time to instructional work, while seven student assistants devoted part of their time to work in their regular College courses. On the basis of full time for each instructor, the instruc-

Numbers.

Division of Work.

tional work for this year was equivalent to the full time of thirty-eight instructors.

For the present year, the faculty comprises ten professors, six assistant professors, sixteen instructors, and two assistants, who devote all of their time to intructional work; eight professors, three asistant professors whose time is divided between the work of instruction and of the Experiment Station, and six assistants, only part of whose time is available for instruction. During this year, the instructing force is equivalent to the full time of forty instructors.

It is a pleasure to report the unselfish devotion of the faculty and other College employees to the interests of their respective departments and of the institution. Their work is characterized by harmony, co-operation and efficiency.

Necessity for Higher Salaries.

The great awakening during recent years in technical education, particularly along the different lines of agriculture, has created such a demand for competent specialists in the Government service and in educational institutions that each year adds to the difficulty encountered in securing and retaining the services of strong, capable men as heads of departments. In the report of the President, four years ago, and again two years ago, this question was discussed and the importance of increasing the salaries of professors until they approximate, at least, the salaries paid for similar work by other institutions, was emphasized. Since that time, there has been a substantial increase in the salaries of the professors; and yet, notwithstanding this, two professors have resigned their positions at the College within the last year to accept similar positions in other institutions at higher salaries: Professor Clark of the Department of Animal Husbandry, who went to the Agricultural College of Montana, and Professor Upham of the Department of English Language and Literature, who went to Miami University, Ohio. Professor William Jardine, also, who was graduated from the College with his degree in Agriculture in 1904, and who was employed as assistant professor of Agronomy in 1905, and promoted to a professorship in 1906 at a salary of $1,800 a year, has submitted his resignation to take effect February 1st, that he might accept a position with the U. S. Department of Agriculture at a salary of $2,000 a year, with the understanding that on July 1, 1907, his salary is to be increased to $2,250.

It must be apparent, therefore, that whatever economy it may be necessary to exercise in other respects, if greater permanency is to be secured in the positions of heads of departments—instructional and experimental—and a more stable policy thereby maintained, it will be necessary to provide an additional increase of from one to three hundred dollars a year in the salaries of a number of the professors.

CHANGES IN COURSES OF STUDY.

Adaptation to Needs of People.

One of the main purposes in the establishment of land-grant colleges was to provide an education that should reach the masses of the people. These institutions have been pioneers in many respects in the development of industrial education. Their policy has been to adapt their plans to the needs of the people in the several states. It has been necessary in most of the states to maintain preparatory courses for the accommodation of students who have not been prepared to enter upon the more advanced work.

Preparatory Courses.

At the time the Agricultural College of Utah was established, there were very few schools in the State prepared to do the work required for admission to its regular courses. Large numbers of young men and women, who desired to take advantage of the training [redacted] by the institution, had been denied the advantage of an education and were too old to attend the public schools. To accommodate such people, preparatory courses were established, and for more than a decade these courses were attended by large numbers of students. During recent years, however, as the public schools of the State have advanced there has been a resultant corresponding decrease in the demand upon the College for elementary work of a general character.

Sub-Perparatory Course.

Last year only thirty-six students were registered in the Sub-preparatory course, and at the beginning of the present year this course was discontinued. While the change causes a small temporary decrease in the total attendance, the general effect is to advance somewhat the standard of efficiency in other courses.

The conditions throughout the State are such that it will

no doubt be necessary for many years to provide at the College for secondary or high school work along industrial lines, such as agriculture, mechanic arts, domestic arts, and commerce. As industrial schools are established in different parts of the State, or better still, as industrial courses are provided for in the regular high schools, the work of secondary grade at the College can be gradually eliminated, until eventually the work of this institution may be confined to the regular courses of college grade.

Industrial High School Courses.

The most important event of the biennium in an educational way was the passage of the law by the State Legislature at its last session prohibiting the College from offering courses in engineering. At the time the College was first opened for the admission of students in 1890, courses were announced in civil engineering, mechanical engineering, mining engineering, and irrigation engineering. No work, however, was attempted in mining engineering, and in 1894 the work in irrigation engineering was merged with the civil and mechanical engineering courses. Therefore, the irrigation engineering course, as such, and the mining engineering course had not been announced since 1894; but the civil and mechanical engineering courses had been given from the time of their establishment in 1890. From these courses there had been students graduated with degrees each year since 1894.

Law Eliminating Engineering Courses.

Previous to the time of the passage of the law referred to, students had been entering each year for the engineering work, expecting that, as announced in the official catalogues, they would be allowed to pursue their courses to completion. Hence it was decided by unanimous vote of the Board of Trustees, at a meeting held July 8, 1905, that the College was "under obligation to allow the students who had already entered the institution for engineering to continue their courses and graduate upon completion of the work required at the time of entrance," but that no new students should be allowed to enter the College for the engineering work prohibited by the act of the Legislature. Notwithstanding the fact that under this resolution of the Board of Trustees the students in engineering were to be allowed to continue their work in the College, the effect of the law was

Obligation of College to Engineering Students.

that many of the engineering students went to Stanford, Harvard, and Purdue universities to complete their courses.

The importance of engineering in land-grant institutions is shown by the fact that, with one possible exception, every agricultural college in the United States offers courses in engineering. This is true, first, because the provisions of the Federal law of 1862, and of the supplementary act of 1890, under which the land-grant colleges are organized, emphasize mechanic arts, which, as interpreted by the Department of the Interior, and agreed by educational authorities throughout the country, comprise all lines of engineering as distinctive features of these institutions, co-ordinate with the agricultural and other courses; and second, because of the close and vital interdependence of the agricultural and engineering work in the development of the country's industries. The importance of engineering in these institutions is further indicated by the comparative registration of students. For example, notwithstanding the great awakening during recent years in agricultural education, there were in 1904-1905, as shown by the report of the Office of Experiment Stations, but 2,638 students registered in the degree courses in agriculture, while there were 12,334 students in engineering. Even if the number of students in the short high school and winter courses in agriculture—4,634—should be added, the comparison would then be 7,272 students in agriculture to 12,334 in engineering.

Importance of Engineering in Land-Grant Colleges.

Referring to the importance of this question to the Utah institution, Professor Jenson, in his report to the President, says:

"Should the law above referred to be allowed to remain upon the statute books a permanent and irreparable injury will have been done the Agricultural College. . . . The work in engineering is so closely and intimately associated with the agricultural work of instruction and research, that its elimination renders the curriculum of the College incomplete, and its remaining work one-sided and more or less inefficient."

President Storms of the Iowa State College of Agriculture and Mechanic Arts, in his report for 1903-1905, says:

"I wish to call attention to Dean Marston's argument con-

cerning the close association of agricultural and engineering studies and research. There is a kindred purpose and spirit between these two great branches of research and instruction that make them as mutually helpful each to the other and dependent each upon the other, as are two oars of a boat."

From the report of Dean Marston, referred to by President Storms, is taken the following:

"Moreover, in Iowa all the branches of engineering and engineering industries depend quite directly upon agriculture."

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Inter-dependence of Agriculture and Engineering.

"The different branches of engineering work can be taught properly only by men engaged in original study and research in their special subjects, since only by such men can engineering work be kept fully up with the times and the necessary inspiration given students. In Iowa such original study and investigation require the co-operation of those in charge of scientific agricultural investigation and the opportunities afforded by their facilities for investigation work.

"For example, drainage in Iowa must be studied jointly by the engineers and agriculturists, as we are doing in our college work. The engineer alone cannot properly study the effect of drainage on soils and crops any more than the agriculturist alone can properly study the design, construction and maintenance of drainage systems."

After giving other examples of the interdependence of engineering and agricultural work, Dean Marston concludes this part of his report with the following statement:

"From every point of view then it seems certain that in Iowa engineering and agricultural research and education should go hand in hand."

What Dean Marston says of the importance of associating agricultural and engineering work in Iowa is equally true in Utah. While the conditions in the two states are not in all respects the same, and the work must vary to meet local requirements, the same close relations of interdependence exist

Necessity for Irrigation Engineering.

between these two great branches of study and investigation. Many of the most important problems encountered in the development of the agricultural interests of Utah can be solved only by the co-operative efforts of the trained engineer and the specialist in different subjects of technical agriculture. Irrigation engineering, particularly, is of the utmost importance in the arid inter-mountain region. Whatever the final decision may be in regard to the practicability of having civil and mechanical engineering restored to the Agricultural College, it cannot be too strongly urged that a course in Irrigation Engineering, at least, be provided for in this institution.

BUILDINGS AND IMPROVEMENTS.

Destruction of Mechanic Arts Building.

As reported by the Superintendent of Buildings, the most important building operation of the biennium was the restoration of the Mechanic Arts Building, which was destroyed by fire on September 11, 1905. In addition to the insurance, $7,100, it was estimated that the reconstruction of the building and the restoration of the equipment would cost $26,288. For this amount the Board of Trustees petitioned for authority to incur a deficit, and the State Board of Examiners, at a meeting held on September 20, 1905, generously granted the petition. Immediately thereafter, orders were placed for the equipment, and arrangements were made to begin the work of restoring the building.

It is a source of gratification to note that in this disaster of the College expressions of sympathy and proffers of assistance were received from many of the leading citizens throughout the State.

Restoration of Mechanic Arts Building.

After the architects' estimates were made of the cost of restoring the building, it was discovered that the walls were damaged to a much greater extent than was originally thought, and it became necessary to remove the remaining walls and about one foot of the foundation of the main front, and several feet from the top of the rear walls, thereby adding considerably to the cost of reconstruction. As shown by the Secretary's Report, the aggregate cost of the building and equipment has been $39,321, which, after deducting $500 received in donations from the architects and contractors and in sales of salvage from the fire, left a balance of $5,985 in

excess of the original estimate. This amount, of course, had to be provided for from the maintenance fund.

The new building is in some respects very much superior to the old structure which it replaces. Among the improvements are the cement floors in the motor room, forge shop, room for carriage building, and the machine shops for wood and metals. The storage room, which was originally constructed of wood and iron roofing, was built of brick, and the wash and toilet room, formerly in the attic, was provided for on the first floor, with entrances from both the carpenter and forge shops. Dormer windows were also provided in the roofs of the forge shop, the carriage shop, and the foundry.

The New Building.

Great credit is due to the Director of Mechanic Arts, and to the foremen, employees, and students of the Department for the assistance they rendered in the work of reconstruction, a detailed statement of which is given in the Director's report.

The only other important improvements are the construction of additions to the greenhouse, as described in the report of the Professor of Horticulture and Botany; the completion of the east wing of the cattle barn, and the construction of sheds for the care of animals used by members of the faculty, the students, and the public; the removal of the vault, from the rooms used originally by the Secretary, which provided class room for the work in animal husbandry and veterinary science; and the completion of the basement of the Station building, providing room for mailing and photographic work.

Other Improvements.

AGRICULTURE.

During the past two years the agricultural work has been extended and very much improved.

For a number of years the work in veterinary science was given in the Department of Agronomy. In 1903 the work in Agronomy had increased to such an extent that this Department was relieved of the veterinary work, which was transferred to the Department of Animal Husbandry and Dairying. During the following two years there was a very rapid growth in the work of this Department. There was also an increased demand for veterinary work throughout the State, and a corresponding increase in the call for veterinary instruction at the College. It became necessary,

Professorship Established in Veterinary Science.

therefore, to provide for the veterinary work in a separate department, and at the beginning of the year 1905-1906 a professorship in Veterinary Science was accordingly established. To this professorship, Dr. H. J. Frederick, a former student of the College, who had recently been graduated with his degree from the School of Veterinary Medicine of the Iowa State College of Agriculture and Mechanic Arts, was elected. During the year 1905-1906, the College and Station together employed only one-half of Dr. Frederick's time, the balance being devoted to private practice in veterinary medicine. A number of new courses in veterinary science were offered, and there was such demand for the work, instructional and experimental, that it became necessary at the beginning of the present year to arrange for Dr. Frederick to devote his entire time to the Department.

Irrigation and Drainage.

In 1905 a separate department was established in Irrigation and Drainage. To this professorship, Mr. W. W. McLaughlin, a graduate from the Civil Engineering Course of the College of the class of 1896, was elected. Professor McLaughlin had been the Irrigation Engineer of the Utah Experiment Station, and was, at the time of his employment, in the service of the U. S. Department of Agriculture in co-operative work with the Agricultural College of Montana. In addition to his instructional work, Professor McLaughlin is Station Irrigation Engineer and in charge of the Irrigation and Drainage work being done throughout the State in cooperation with the U. S. Department of Agriculture.

In 1905, also, Mr. William Jardine was elected Assistant Professor of Agronomy and placed in charge of the instructional and experimental work of this department, as explained elsewhere in this report. In 1906, Mr. John Stephens, a graduate from the short course in Agriculture, was elected Assistant Agronomist and Superintendent of Farms, to succeed Mr. J. B. Nelson, who had resigned his position in the College to accept a similar position in the Agricultural College of Montana.

At the beginning of the present year, Professor R. W. Clark resigned his position in the College to accept a similar position in the Agricultural College of Montana. During the three preceding years, the number of students pursuing the different courses in Animal Husbandry and Dairying had increased more than one hundred per cent. The establishment

of condensed milk factories in the State, and the large increase in the demand for dairy products, added greatly to the importance of both the experimental and instructional work of this Department. In order that the increased demands might be met, and efficient work insured in all of the courses offered, it was deemed necessary, upon the withdrawal of Professor Clark, to segregate the work and to establish a Department of Dairying. Mr. John T. Caine, III., who was graduated from the agricultural course of the College in 1903, was elected Assistant Professor of Animal Husbandry. Mr. Caine had pursued a graduate course in the Iowa State College of Agriculture and Mechanic Arts, from which he received his Master's degree in agriculture in 1905. He had also been assistant in the experimental work in Iowa and had had some experience in the stock yards of Chicago. His thorough scientific training and his familiarity with local conditions affecting the live stock industry, peculiarly fit him for the duties of the Department.

Animal Industry and Dairying.

Professor Christian Larson of Iowa was elected to the Professorship in Dairying. At the time of his employment, he was Associate Professor of Dairying in the Iowa State College of Agriculture and Mechanic Arts. He had received his Master's degree from that institution, and had had a broad experience, not only in the instructional and experimental work at the Iowa College, but also in farmers' institute and in practical creamery work throughout Iowa and adjoining states. He is joint author with Professor McKay, of the Iowa College, of a work on the "Principles and Practices of Butter Making," which is used as a text-book in practically all of the dairy schools of the country. He has also written several press bulletins and has done considerable writing on subjects relating to the dairy industry for different agricultural publications. Since he assumed the duties of his position at the College, he has outlined several new courses in dairying, and a number of important improvements have been made in the work of the Department. He has also visited most of the large creameries and is studying local conditions with the view of rendering such assistance as may be possible in the development of the dairy interests of the State.

Prof. Larson.

At the beginning of the present school year, Professor James Dryden, after an absence of two years from the Col-

lege,—one year in the Agricultural College of Montana, and one year as manager of the poultry plant of the Cyphers Incubator Company of Syracuse, New York,—returned to this institution as Professor of Poultry Husbandry. During Professor Dryden's former connection with the College he had not only distinguished himself as an expert in poultry culture, but had brought renown to the Agricultural College of Utah as the leading institution in poultry work in the United States. His bulletin No. 92, published in 1905, is accepted generally throughout this country, and in many foreign countries, as the most authoritative and valuable publication on poultry experiments. As an indication of the value placed upon Professor Dryden's work by experts, the following statement is taken from an article recently published by the American Poultry Advocate, Syracuse, New York. This article was written by Mr. A. F. Hunter, probably the most favorably known poultry editor in the United States:

Prof. Dryden.

"A bulletin entitled, 'Poultry Experiments,' comes to us from the Experiment Station of the Utah Agricultural College, which seems to be one of the most comprehensive, hence one of the most valuable that has come from any experiment station. . . . We heartily welcome this edition to our poultry knowledge, and congratulate the State of Utah upon the good work its experiment station has done in publishing this bulletin.

"Such studies as those reported in this bulletin are of the greatest value. They are not the 'theories' of someone with a hobby, but are the records of studies made for the sole purpose of ascertaining facts; and exact knowledge is what the poultry interest has longed for. . . . Gladly do we welcome so important an addition to our poultry literature, and heartily do we thank the State of Utah and Mr. Dryden for giving it to us."

Success of Poultry Experiments.

Professor Dryden's return to the College adds strength not only to the Poultry Department, but to the entire School of Agriculture and to the institution. In addition to his poultry work, instructional and experimental, Professor Dryden is editor of the Farmers' Institute Annual, and of the College paper, "Rocky Mountain Farming," referred to in another part of this report.

Professor E. D. Ball of the Department of Zoology and Entomology was granted leave of absence for the year 1905-1906 for the purpose of pursuing advanced work in the University of Ohio. Assistant Professor E. G. Peterson was placed in charge of the Department during Professor Ball's absence.

Not only has there been marked improvement in the organization and work of the School of Agriculture, but there has been a large increase in the number of students registered in the different agricultural courses. As stated above, there has been an increase during the past three years of more than one hundred per cent in the number of students pursuing courses in Animal Husbandry and Dairying. From 1904-1905 to 1905-1906 there was an increase in the number of students in Agronomy of more than sixty per cent. Last year in the Department of Horticulture and Botany there were registered fewer than fifty students, while the attendance up to date this year is 128, and others will register at the beginning of the second term.

Increase in Number of Agricultural Students.

The comparative remarkable growth during recent years in the agricultural work of the College is due, first, to the rapidly growing appreciation on the part of the people of the value of agricultural education, and second, to the superior facilities provided for the work by the construction of new buildings and the purchase of suitable laboratory equipment. As shown by the statistics of the Registrar, printed in the last biennial report, the number of students pursuing agricultural work during the year 1899-1900 was ten, most of whom were in the short winter course in Dairying. In the President's report the following year, a plea was made for farm buildings and extended equipment for the agricultural work; and it was urged that, while the registration of students in the agricultural courses had not been so large as in some other departments, this was "no doubt due largely if not entirely to the meager facilities for work in agriculture. We cannot expect students in this department until we are prepared to give them the very best instruction possible in the particular lines in which they have interest." It was further stated that "if the Department of Agriculture in the College be equipped for successful work, and the courses so arranged as to meet the agricultural demands of the State, and ad-

Reasons for Rapid Growth.

justed to the requirements of those who desire to pursue them, there will no longer be any difficulty in securing agricultural students."

The Legislature, then in session, made the necessary appropriations, and during the two years following the cattle and sheep barns were constructed, the horse barn was remodeled, pure-bred stock were purchased, the soil physics laboratory was equipped, and other improvements were made, which added materially to the facilities for the work in agriculture. Since then, the hog and poultry buildings have been constructed and additions have been made to the equipment, consistent with the means available, as required in providing for the needs of the students in the agricultural courses. The agricultural faculty, also, has been strengthened from time to time, as the growth of the work required and conditions warranted. The fact that the attendance in the agricultural courses has increased during this period more than eleven hundred per cent, as shown by the reports of the Registrar, is sufficient proof of the wisdom of the policy which has been pursued.

Increased Facilities.

The growth of the agricultural work during the years mentioned has been comparatively much larger than that of the other departments of the institution and places the College in the front rank among the best land-grant institutions of the country in both the amount and character of its work in agriculture. From the Report of the Office of Experiment Stations for the year ending June 30, 1905, have been compiled tables showing the number of students in each land-grant institution pursuing courses in agriculture, in proportion to the total population, and to the farm population, and in comparison with the value of the agricultural products of each state. It is interesting to observe from these tables that, while the Agricultural College of Utah is one of the youngest land-grant institutions, it ranks first in the number of agricultural students, exclusive of those in short special winter courses, in proportion to the total population of the State; and only fourth in the total number of agricultural students in proportion to the farm population of the State. Furthermore, while the average farm population in the United States is upwards of 3,700 to each agricultural student in the land-grant institutions, the farm population in Utah is only

Agricultural Education in Utah and Other States.

836 to each agricultural student in the College. For comparison, the following table shows the farm population, the degree students in agriculture, the short course students in agriculture, the total number of students in agriculture, in each of a number of representative states, including those whose land-grant institutions are the best in the country.

STATE	Population in Farm Homes	Students in Four Year Agricultural Courses	Students in Short Agricultural Courses	Total Agricultural Students	Farm Population for each Agricultural Student
California	308,891	64	42	106	2,914
Colorado	104,701	19	145	164	638
Georgia	1,077,138	30	32	62	17,373
Idaho	74,091	4		4	18,522
Illinois	1,219,852	123	170	293	4,163
Indiana	973,870	76	85	161	6,048
Iowa	1,037,811	347	626	973	1,066
Kansas	763,186	162	123	285	2,678
Michigan	893,342	152	158	310	2,881
Minnesota	779,470	29	230	259	3,009
Missouri	1,340,079	76	170	246	5,447
Montana	60,588	4	17	21	2,285
New York	1,010,376	98	309	407	2,482
Ohio	1,237,790	119	178	297	4,167
Tennessee	1,135,885	21	29	50	22,711
Utah	96,308	14	101	115	836
Vermont	138,830	44	12	56	2,478
Wisconsin	823,478	80	474	554	1,486

Importance of Work of Agricultural Colleges.

The importance of the work accomplished in the land-grant institutions in the development of agriculture can hardly be overestimated. As stated by Dr. True, of the Office of Experiment Stations, in his report for 1905:

"The vastness of agricultural problems, when considered in the aggregate, is almost beyond comprehension. When account is taken of the fact that the production of wealth on farms in the United States in 1905 reached the stupendous aggregate of $6,415,000,000, and that this represents an increase of $256,000,000 over the production in 1904, the importance of any one discovery affecting favorably the production of agricultural wealth is apparent. And this vast increase in

productive capacity is due primarily to improved methods in farm practice. . . . Credit for this additional wealth-producing power must therefore be given mainly to the use of improved field crops, fruits, and animals; to better methods of cultivating, fertilizing, harvesting, and marketing crops; to more rational practice in feeding and caring for farm animals, and to the more general and successful use of preventives and remedies for diseases and insect pests of plants and animals."

Secretary Wilson of the Department of Agriculture, in his report for 1906, says:

"In accordance with the principles demonstrated, known, and applicable, hints of which have been given, the corn crop per acre can be increased by one-half within a quarter of a century, and without any pretense that the limit has been reached. No wizard's services are needed for this, but just education.

Secretary Wilson's Views.

"The same statement is applicable to wheat. There is no sensible reason why half as much again wheat may not be had from an acre within less than a generation of time. It is only a question of knowledge, of education, of cultural system, and of farm management, all of which learning is and will be at the service of the farmer as he needs it.

"Equally feasible is a 50 per cent increase in the crops per acre of oats, barley, rye, and buckwheat. Potatoes, instead of growing less than 100 bushels per acre, should double their production."

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"One fourth of the dairy cows of the country do not pay for their feed, and more than half of them do not return any profit; in proportion as the dairyman weighs the milk of each cow and applies the Babcock test will he increase the supply of milk, butter, and cheese. It is merely a matter of education."

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"The farmer will not fail the nation if the nation does not fail the farmer. He will need education to know the powers of the soil which are now hidden from him. The prospective yearly expenditure of $10,000,000 for educational and research

work by Nation and States, with such increases as may come from time to time, must have enormous effects."

The function of the land-grant colleges, in the development of agriculture, is twofold: first, through the department of research and experiment, to solve the problems encountered in agricultural practice; and second, through the departments of instruction, to educate the people in the applications of agricultural science.

The work of the Agricultural College of Utah along the line of investigation has already produced results of a monetary value far in excess, no doubt, of the entire amount expended by the State for the maintenance of the institution since the time of its establishment. For example, it has been demonstrated that by selecting certain varieties of wheat, oats, and other grains best adapted to Utah soils and conditions, the yield per acre would thereby be largely increased. As reported in the Yearbook of the Department of Agriculture for 1905, the acreage in wheat in Utah was 178,417, with an average yield per acre of 26.4 bushels, aggregating in value $3,155,000. If, by following the instructions of the Experiment Station, the average yield could be increased two bushels per acre, a small increase compared with that predicted by Secretary Wilson, the result would be a total increase for the year of 356,800 bushels, which, at 67 cents per bushel, the average price paid in 1905, would amount to $239,000, nearly three and a half times the largest appropriation made to the College by the State for any single year. Again, it has been shown that by following certain instructions in cutting and curing alfalfa, the increase in the value of this crop would be about 10 per cent. If this estimate should be reduced one-half, the annual increase in the value of alfalfa hay would then exceed the total amount required to support the institution. These are only two illustrations. If the work done in connection with other field crops, in irrigation and drainage, in animal husbandry and dairying, in poultry management, in horticulture, in entomology, etc., be added, some conception may be had of the magnitude of this work and of the results already achieved.

Value of Experiments Conducted by Utah Station.

But the discovery of knowledge becomes of value in the advancement of agriculture only in proportion to the extent

Agricultural Instruction Needed. that the people are instructed in the application of the principles involved. For this work there are two principal agencies: (1) regular instruction to College students, in the special winter courses, the high school course, and the degree course; (2) extension work, the purpose of which is to carry instruction directly to the people by means of lectures, institutes, publications, and personal correspondence.

In the above discussion the value of agricultural education and research has been emphasized as a means of increasing the productiveness of the farm and developing the resources of the State. But, after all, important as are the economic results of this work one of the

Training for Citizenship. chief functions of any school is to inspire high ideals of living and to train men and women for general citizenship. As stated by Dean Bailey, the modern school of agriculture "concerns itself with large public interests of education, trade, transportation, and general betterment, standing for all agencies that will aid in making the farmer a more efficient producer of wealth and a more effective citizen."

Detailed statements of the needs of the different departments of agriculture for the next biennium are given in the department reports. In addition to the supplies

Needs. and incidental equipment required, are the pure-bred live-stock, feeding sheds, incubator cellar, and improvements in the dairy and veterinary hospital. Additional land will also be needed for experimental work, as explained in the report of the Director of the Experiment Station.

In considering the recommendations of the heads of departments, it should be borne in mind that the barns, fields, and other outdoor equipment constitute the laboratories for much of the most important agricultural work. While the College barns are admirably adapted to the purposes for which they were constructed, there is need for sheds for feeding experiments, in order that the Federal appropriations for this work may be used to advantage. Too much

Pure-Bred Live-stock. importance cannot be attached to the value of pure-bred live-stock in the work in animal and dairy husbandry. Although the College now owns several good breeds of pure-bred stock, the number is

still inadequate for the requirements of the work. As explained in the Department report, it is very desirable that a team of pure-bred mares be purchased for breeding purposes and for use in stock-judging. This team could also be used to good advantage for general work on the farms. While the amount required for live-stock may appear large, it is very conservative compared with the amounts expended by other institutions. For example, Michigan recently appropriated $20,000 for the purchase of live-stock for the Agricultural College of that State. For the year 1905-1906, the Legislature of Illinois appropriated $50,000 for live-stock investigations alone, besides an additional $100,000 for the biennium for instructional work in agriculture, a part of which also would be used in the purchase of live-stock. Although the Iowa agricultural college is perhaps the best equipped institution in the country for animal husbandry work, yet the last legislature of Iowa appropriated $10,000 for the purchase of live-stock "to be used on the College farm for instructional work."

In the last report of the President, the necessity of procuring additional land for experimental purposes was referred to. As explained in the report of the Director, 5.15 acres had been leased for a term of years, with the option of purchase at the expiration of the lease. Since the term of the lease expires within the next year, it is important that provision be made for the purchase of the land. In this connection, it may not be inappropriate, as an illustration of the land requirements of agricultural colleges, to refer to the fact that, while the original farm of the Iowa State College comprised 840 acres, the last General Assembly of that State appropriated $32,000 for a dairy farm of 200 acres, and that in the subsequent report of the College officers the request is made for $11,000 for the purchase of an additional tract of about sixty acres.

Land Required.

Special attention is called to the argument of Professor Dryden for an appropriation of $500 for an incubator cellar and building. The increase in the value of the work in incubation and brooding, and in the income from the poultry plant will be sufficient to amply justify this expenditure.

Incubator Cellar.

In addition to the laboratory equipment in Horticulture and Botany, the most pressing need of this Department is

Instructor in Botany. for an additional instructor. The duties of the Professor of Horticulture and Botany, in connection with the work of the Southern Experiment Station, the Central Experiment Station, and the experimental work at the College, have increased to such an extent that it is impossible for him to give all of the courses required in both horticulture and botany. The importance of this work demands that an able instructor be employed at the beginning of next year for the work in botany.

VETERINARY COURSE.

Special attention is called to the recommendations of Dr. Frederick regarding the establishment of a degree course in Veterinary Science, and the importance of the passage of a law by the next legislature establishing the office of State Veterinarian.

As reported in the Yearbook of the Department of Agriculture, the aggregate value of the live-stock in Utah in 1905 was upwards of $20,200,000. From investigations that have been made, there can be no doubt that tuberculosis exists to a great extent among the cattle of the State. The necessity of using every possible means to prevent the spread of this disease cannot be too strongly urged. Upon this question, Secretary Wilson, in his report for 1905, says:

Tuberculosis Among Cattle.

"Tuberculosis has been studied both as to its effect upon the animal industry of the country and as to the danger of its being communicated to man. It is not uncommon to find herds of dairy cattle where fifty to ninety per cent of the animals are affected with this disease, and in our meat inspection service there have been found in some large abattoirs nearly three per cent of hogs with tuberculosis. The disease, therefore, deserves a most careful study. . . . . A study was made of a herd of 102 cows, 76 of which showed reaction to the tuberculin test."

He further suggests that "the milk of all cows which have reacted to the tuberculin test should be considered as suspicious, and should be subjected to sterilization before using. Still better, tuberculous cows should not be used for general dairy purposes."

During the year 1905 the State Department of Agriculture of Pennsylvania inspected 733 herds of cattle, and condemned 1,352 animals with tuberculosis. The necessity of suppressing this disease is shown by the following statements from the Department Report:

Investigation in Pennsylvania.

"While progress is being made in the repression of tuberculosis of cattle, the disease is so very widespread and affects such a great number of animals that advancement is necessarily slower than of a less prevalent malady."

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"The need for the repression of tuberculosis is two-fold: In the first place, the disease is a very widespread affection of cattle and destroys great quantities of property every year. . . . In the second place, tuberculosis is of importance with relation to public health."

It is further explained in the report that while there are different opinions held among specialists as to whether tubercular bacilli of bovine type will produce the disease in man, recent investigations seem to establish the fact beyond controversy that they do. Independent studies on this question have been made, particularly in Germany and England. Of the number of "German cases investigated, one-seventh, and of the English cases about one-third, were caused by bacilli of the bovine type. . . . It is clearly established that the important point is that the same kind of tubercle bacillus that produces disease in cattle may also produce disease in men. Upon this point there seems to be no room for difference of opinion."

Germany, England.

It is of the utmost importance, therefore, not only in promoting the development of the live-stock industry, but in protecting the health of the people, that as thorough a course as possible in veterinary science be provided for at the College. If Dr. Frederick's recommendations regarding the establishment of a degree course in veterinary science are approved, there should be an additional appropriation of $1,050 for improvements in the hospital and for additional equipment, and of $1,000 for an instructor during the second year of the biennium.

In the President's report for 1904-1905, attention was called to the necessity of having a State Veterinarian. It was suggested that arrangements might be made by which the College Professor of Veterinary Science could also serve as State Veterinarian, his salary being divided between the State and the College. From the foregoing it is apparent that conditions are now such as to make the establishment of this office of the very greatest importance.

State Veterinarian.

DOMESTIC SCIENCE AND ARTS.

The School of Domestic Science and Arts continues to increase in popularity. During the last two years it has maintained its reputation for thorough and efficient work. As reported by Professor Cotey, there has been a general improvement in the courses of study and in the character of the work generally, as well as in the equipment and facilities for instruction. The demand for graduates in educational institutions continues greater than the supply.

Improvement in Work.

The distinction won by the work of the school exhibited at the Louisiana Purchase Exposition in 1904 was repeated at the Lewis and Clark Exposition in 1905, where the exhibit was awarded the highest prize. The professors, instructors, and assistants deserve great credit for their harmonious and efficient efforts in behalf of the students of their departments.

Prizes Awarded.

The requirements of the School for the next biennium include a small amount of miscellaneous and incidental equipment, and the usual appropriation for general supplies and assistance.

COMMERCE.

Special attention is called to the argument of Professor Bexell in his report to the President on the importance of commercial education as a factor in the development of modern industries.

The work in Commerce was first provided for in the College as early as 1891, and has gradually developed with the growth of the institution. The enrollment in the commercial courses is approximately twenty per cent of the total reg-

istration. In this connection it is interesting to note that, while the Department of Commerce is provided with the fixtures and general equipment required for most modern work in the different courses offered, the total average cost per student per year for the past four years for equipment, supplies, and salaries, is only $33, which is much less than the cost per student of the technical work in any of the other College courses.

Cost of Work.

The work of the Department is characterized by efficiency and painstaking thoroughness. The graduates have no difficulty in obtaining good positions. They are found in a number of the banks and other commercial institutions of Utah and adjoining states.

ENGINEERING AND MECHANIC ARTS.

The School of Engineering and Mechanic Arts has suffered serious loss during the past two years, first, in the destruction by fire of the Mechanic Arts Building and equipment, just before the opening of the College in September, 1905; and, second, by the passage of the law by the last Legislature, referred to under "Changes in Courses," prohibiting the College from offering courses in engineering. Special attention is called to the report of Professor Jenson on the work of the biennium and the assistance rendered by the instructors and advanced students in restoring and installing the equipment of the Department; also to the argument in favor of associating agricultural and engineering work in the land-grant institutions.

The work of the Department of Mechanic Arts is more thoroughly organized than ever before and is of an exceptionally high order, ranking with that of the best institutions of the kind in the country. Graduates and students of the Department have no difficulty in obtaining good positions and are unusually successful. The Director, foremen, and assistants merit the highest commendation for the success they have achieved during the past year under the most adverse conditions.

Success under Difficulties.

In connection with the discussion elsewhere in this report in regard to the importance of providing in the College for a course in irrigation engineering, estimates have been carefully prepared showing that should such a course be estab-

Engineering Inexpensive.

lished, an additional appropriation of only $2,300 a year would be required during the next biennium. As shown in Professor Jenson's report, the total cost for the work in Engineering, since the establishment of the institution, has averaged only $2,700 a year, including salaries, equipment, and supplies. In view, therefore, of the uniform success of the graduates from the Engineering courses and the value to the State of the work they have accomplished in irrigation and other projects, there would seem very little argument, indeed, to justify the elimination of the Engineering courses from the College.

For the work in Mechanic Arts it will be necessary to provide some additional equipment in order that the students may be accommodated in the machine work without the necessity of dividing the classes into smaller sections than necessary to insure efficient work. By the expenditure of about $700 for material, a number of very valuable machines that were damaged in the fire can be restored by the students. It is estimated that, in addition to the shop fees, about $6,000 will be required for lumber, iron, steel, and other supplies.

MISCELLANEOUS DEPARTMENTS.

Courses Fundamental to Technology.

Indispensible to the technical work of the College are the different subjects of science, such as Botany, Chemistry, Zoology, Geology, Mathematics and the related fundamental courses in History, Civics, Economics, English and Modern Languages. The standard of work in the technical departments can be advanced only as the basic subjects are developed and made strong. This emphasizes the necessity of providing for the symmetrical growth of all the work throughout the institution. In an effort to strengthen and build up the technical courses, the short-sighted policy should not be pursued of withholding the necessary support from the general or miscellaneous departments. While the comparative needs of these departments are not great, it is important that provision be made for the equipment required in maintaining the standard of efficiency demanded by the technical schools. The estimates of the amounts required during the next two years are given by the professors in their respective

reports. These estimates are very conservative and if possible the full amounts asked for should be allowed.

Military and Physical Training.

The necessity of providing military work for the male students of the College, and the importance of physical training for all of the students, were explained in the last biennial report. For want of adequate room and other necessary facilities, the work of the Military Department and of the Department of Physical Education has been carried on at a great disadvantage. In Physical Education, particularly, is the efficiency seriously impaired by the lack of suitable accommodations.

Library.

No particular change has been made in the work of the Library during the past two years. The most important items to report are the valuable contributions received from the State Historical Library of Wisconsin. Aside from the usual amount required for binding and for the purchase of books for the different departments, about $300 will be needed for additional stacks.

Music.

The differenet organizations of the Department of Music have made very great improvement during the two years, and are an important factor in the social life of the institution, besides providing exceptionally good training to students who are interested in music. While there are several instructors and assistants engaged in the Department, all, except the Professor of Music, depend upon the private fees received from students for their compensation, so that the work is of very little expense to the College.

Summer School.

The Summer School for 1906 was by far the most successful session since the School was established, both in the number of students and in the character of the work done. The purpose of establishing this School was to utilize the excellent equipment of the College in providing the teachers of the State an opportunity to receive the training required in preparation for the introduction into the public schools of agricultural and manual training work. The work is done by members of the College faculty without extra compensation. By action of the Board of Trustees, the Summer School must be maintained without cost to the College. For the last session the receipts from students amounted to $393.50. The ex-

penses were $138.89, leaving a balance of $254.61, which was turned into the College treasury.

EXPERIMENT STATION.

General reference has already been made to the experimental side of the agricultural work of the College. All members of the faculty who are heads of departments in agriculture are also members of the Experiment Station Staff, and have charge of the corresponding work of research and experimentation. What has been said, therefore, of the establishment of professorships in Agriculture, and of the resulting extension and strengthening of instructional work, is also true of the experimental work. Dr. Yoder in his report summarizes the work which has been accomplished during the past two years, and outlines the plans and explains the needs for the next biennium.

Work Extended and Improved.

Through the transfer of the Southern Experiment Station to the College and the establishment of the Central Utah Experiment Station, in connection with the arid farm experiment stations, and the irrigation and drainage experimental tracts, the work of the Station now extends largely over the State and reaches practically every interest involved in the development of Utah agriculture. The additional appropriation coming to the Station from the Federal Government through the passage of the Adams Act adds to the resources for experimental work. Under this Act, $7,000 is available for the present year, and that amount is to be increased $2,000 each year until the total annual appropriation is $15,000. As provided in the Act, this money shall "be applied only to pay the necessary expenses of conducting original research or experimentation bearing directly on the agricultural industry of the United States, having due regard to the varying conditions and needs of the respective states or territories." It is further provided that "the grants of money authorized by this Act are made subject to legislative assent of the several states and territories to the purpose of said grants;" and that said assent shall be given "before the adjournment of the regular session of the legislature meeting next after the passage of the Act."

Sub-Stations.

Adams Act.

It is important that the attention of the Legislature be

directed to the necessity of passing a law accepting the conditions named in the Act. Otherwise, the appropriations will be withheld after the present year.

Responsibility of State.

It should be borne in mind that while this law adds to the amount of means available for experimental purposes, it also places additional responsibility upon the State, which, it is understood, shall provide the necessary buildings for the experimental work paid for from the Federal appropriations. Furthermore, one of the conditions upon which the appropriation was made precludes the possibility of using any portion of the money appropriated for any purposes whatever, except those specifically named in the Act; so that, while the income of the institution is increased, the cost of the instructional work, for buildings, equipment, supplies, salaries, is not thereby in any way reduced.

Irrigation and Drainage.

Your attention is also called to the report of the Director that the United States Department of Agriculture proposes to continue the co-operative work with the Utah Station in irrigation and drainage, on the same terms as those under which the work has been carried on during the past two years. The cost of this work is $10,000 a year, the Department and the State each bearing half the expense.

It is a pleasure to report the improvement which has been made in the work of the Station throughout all its departments. Through the liberality of the State in its appropriations for the work of the sub-stations, the passage of the law above referred to, and the co-operative work with the Department of Agriculture, more means are now available than ever before for this work. With the larger income, it has been possible to strengthen the departments and to extend the field of experimentation to meet the more pressing needs of the State in the development of its agricultural interests.

The following is a summary of the estimates of the appropriations required from the State for the Station work at the College. It is important that, so far as practicable, the appropriations asked for should be made.

	Cattle sheds and yards	$1,200	
	Sheep sheds and yards	400	
Needs	Incubator cellar	500	
from	Silo	250	
State.	Land	750	
	Fencing, planting trees, etc	500	—$3,600
	Electric power and light, maintenance of buildings, etc	2,500	
	Printing	3,000	— 5,500
	Grand total		$9,100

The above estimates of the cost of the cattle and sheep sheds are the amounts given by the head of the Animal Husbandry Department. It will be observed that Dr. Yoder, in his report, places the amounts required for these buildings at $1,500 and $600 respectively. While the experience of the past in building operations would indicate the probability of the larger amounts being needed, yet if provision is not made in these buildings for the storage of feed, the smaller amounts will no doubt be adequate.

In connection with the request of Professor Dryden for the incubator cellar, it is interesting to note that, although the Poultry work of the Utah Station is not excelled by that of any other Station in the country, the total amount expended by the State for buildings and other facilities for this work is less than $4,500. The Iowa State College of Agriculture and Mechanic Arts, which is just establishing a poultry department, asked the Legislature of Iowa for $20,000 for this department.

It is recommended that whatever amounts are allowed for experimental purposes be appropriated directly to the Experiment Station, and thereby kept entirely apart from the instructional funds.

COLLEGE EXTENSION.

Probably the most pressing need at this time in the development of agriculture is for that phase of instruction which brings to the farmers up-to-date information on agricultural subjects. It is coming to be recognized more and more that the question of superseding by modern, scientific work, the wasteful methods that have characterized agriculture in the past is

largely a question of educating the people on the farms. Hence the emphasis which has been placed during recent years, both in this country and in Europe, upon the necessity of extension work in agriculture. So important is this work now regarded that Prof. Bailey of Cornell University recently reported that "it is a question whether it is not the most vital just now of any agricultural teaching." At the meeting of the Association of American Agricultural Colleges and Experiment Stations held last November, the report of the Committee on Extension Work was adopted, recommending that each of the land-grant institutions "organize as soon as practicable a Department of Extension Teaching in Agriculture." Director True, in his report for 1905, says: "The most notable feature of the progress of the work of agricultural colleges during the past year has been the increase in the number and variety of enterprises for extension work."

Importance of Extension Work.

Regular college extension organizations for agricultural education have been perfected in several States. In fourteen States special railroad trains were sent out during the year 1905-1906 with speakers and illustrative material for work in a variety of subjects of particular local importance. Some of the States are maintaining regular extension publications. For instance, in the State of New York the extension department of the College of Agriculture publishes the Junior Naturalist Monthly; the Home Nature-Study Course, issued quarterly; bulletins of the Farmers' Reading Course and of the Farmers' Wives' Reading Course, each issued monthly; and the bulletins of the Experiment Station. Farmers' institutes are now held in all of the States and Territories except Alaska. During the year ending June 30, 1906, 11,000 sessions were held, with an attendance of more than 1,000,000. In England, Belgium, France, and other countries of Europe, movable schools have been established as an important feature of extension work. These schools comprise courses of from ten to twenty lectures, demonstrations, and practicums, upon various agricultural subjects adapted to the needs of different localities.

Exetnsion Enterprises.

In 1906 an Extension Department was established in the Agricultural College of Utah, for the purpose of bringing together into effective organization the different agencies of the College for extension work. The Department comprises lec-

Extension Department Established.

tures, institutes, conventions, correspondence, and publications, including Rocky Mountain Farming, special bulletins and reports, farmers' institute annuals, and reports and bulletins of the Experiment Station. Rocky Mountain Farming is published monthly as the official organ of the Extension Department. It is expected to be largely self-supporting, the receipts from advertising and subscriptions being sufficient to pay the cost of printing. It comprises the departments of Irrigation and Drainage, Field Crops, Orchard and Garden, Injurious Insects, Livestock, Dairy Farming, Poultry, Diseases of Animals, The Home, Farm Mechanics, and Profit and Loss,—all edited by College specialists. This publication affords an exceptionally good means through which the people may receive directly and regularly up-to-date and important information relating to the farm and the home.

Rocky Mountain Farming.

Farmers' Institutes have been held since 1896, when the Legislature passed a law appropriating $1,500 a year for this work. During the past two years 106 sessions have been held in fifty-one towns, with an aggregate attendance of about 9,000. Upwards of sixty different subjects have been treated, the work varying with the conditions in different localities. A special effort has been made to have local Institutes established in the farming districts throughout the State, and to arrange for County Conventions. There has followed a much greater and more active interest among the people, and more thorough and systematic work has been accomplished. One very pleasing and profitable feature has been the large number of local speakers who have participated in the Institutes.

Farmers' Institutes.

FINANCIAL.

In the last biennial report some statistics were given showing the comparative cost of instruction in the technical courses and in the different subjects of science, mathematics, history, English, etc. It was shown that the cost per unit of registration in the College ranged from 92 cents in English, and between $5.02 and $6.82 in the sciences, to as high as $10.06 in the department of Agriculture.

Cost of General and Technical Courses.

The cost of the work in the corresponding departments of the University of California ranged from $1.94 and between $4.76 and $7.33, to as high as $11.95. While these statistics relate only to the two institutions, they are sufficient to indicate the great difference in the cost of the scientific and technical courses, and of such subjects as pure mathematics, history, and the languages. The most expensive kind of educational work is that which characterizes the distinctive courses of the land-grant colleges.

Distribution of Funds.

The following table has been prepared from the reports of the Secretary and the Registrar showing the distribution of funds among the technical schools of the College during the past six years, and the average expenditures on the basis of enrollment, for special buildings, equipment, supplies, and salaries.

SCHOOL	1901—1903	1903—1905	1905-1907*	Total	Average Expenditure per Student.
AGRICULTURE:					
Expenditures, less fees and sales	$ 28,957.93	21,412.03	29,077.88	79,447.79	167.26
Enrollment.	70	189	216	475	
DOMESTIC SCIENCE & ARTS:					
Expenditures, less fees and sales	$ 6,140.14	10,696.21	12,117.54	28,893.89	41.63
Enrollment.	198	265	231	694	
ENGIN'ING & MECHANIC ARTS					
Expenditures, less fees and sales	$ 12,190.33	37,711.08	28,902.50	78,803.91	92.49
Enrollment.	223	328	301	852	
COMMERCE:					
Expenditures, less fees and sales	$ 6,116.16	7,895.96	7,744.47	21,786.59	30.01
Enrollment.	213	242	271	726	

The relative average expenditure per student in agriculture, as given in the above table, is considerably larger than it otherwise would be on account of the comparatively large amounts expended for agricultural buildings and equipment, as explained elsewhere in this report, and of the small number of students pursuing work in agriculture during the first biennium. However, the agricultural work is much more expensive than that of any of the other schools.

*The cost of the last seven months of this biennium is based on the appropriation to each school. The enrollment for the year 1906-7 is incomplete, as students will enter at the beginning of the second term.

From the report of Dr. True of the Office of Experiment Stations of the U. S. Department of Agriculture for 1905, the following tables have been prepared. The first table gives the total income, the enrollment, and the income per student in each of the institutions named for the year ending June 30, 1905.

INSTITUTION.	Total Income.	Attendance.	Income per Student.
Colorado Agricultural College	$106,048	496	$213
University of Idaho	78,295	333	235
Indiana (Purdue University)	329,790	1534	214
Iowa State College	446,211	1980	225
Kansas Agricultural College	151,833	1462	104
Michigan Agricultural College	244,865	1009	242
Montana Agricultural College	65,844	399	194
University of Nebraska	456,618	2728	204
University of Ohio	477,610	1835	260
North Dakota Agricultural College	171,647	721	238
Utah Agricultural College	92,048	733	125
Washington State College	117,109	793	147
University of Wyoming	44,478	283	157

As shown by this table, the cost per student in the institutions given ranges from $104 in Kansas to as high as $260 in Ohio, the cost per student in Utah being $125. The amount expended per year per student in Utah exceeds that of only one other State. In the other institutions named the cost is from 17.6 per cent to upwards of 100 per cent higher. This difference in the cost per student might be attributed to a difference in the grade of work done, but an examination of the standard maintained by most of these institutions does not bear out this assumption. For example, North Dakota has 637 students pursuing work in the preparatory and short courses; Kansas, 753; Washington, 514; Colorado, 327; Michigan, 340; Idaho, 159; Wyoming, 233; Montana, 260. If the number of students in the short winter course in agriculture in the Iowa State College be deducted from the total number of students, and the number of students in the winter course in agriculture and in the summer school be deducted from the total number of students in the Agricultural

Income per Student.

College of Utah, the income per student is shown to be $308 for Iowa and $154 for Utah.

The following table* gives the total value of the plant of each institution named, including grounds, buildings, and equipment, and the value of the plant per capita of registration.

Institution.	Value of Plant.	Value of Plant per Student.
Colorado Agricultural College	$ 413,861	$ 834
University of Idaho..............	298,737	897
Indiana (Purdue University).....	950,900	619
Iowa State College	1,354,064	683
Kansas Agricultural College	717,721	498
Michigan Agricultural College....	825,775	818
Montana Agricultural College....	217,500	715
North Dakota Agricultural College.	302,002	418
Utah Agricultural College	363,737	513
Washington State College	398,000	502
University of Wyoming	358,496	1,266

The total value of the property of each institution per capita of registration ranges from $418 in North Dakota to $1,266 in the State of Wyoming. North Dakota, Kansas, and Washington have a lower value of property than Utah in comparison with the enrollment.

Mill Tax.

In the report of the President for 1901-1903, the desirability of providing a permanent fund for the support of the College by a statutory levy in the form of a mill tax upon the property of the State was discussed at considerable length. Quotations were given from letters received from the presidents of the leading colleges and universities which are maintained, in whole or in part, by this plan. State Superintendent Nelson, in his report for 1901, 1902, and again for 1902, 1903, urges the importance of the mill tax plan for the support of the State higher institutions of learning. Should this plan be adopted by the Legislature, the tax should be sufficient to

*This table and the table preceding have been compiled from the statistics given on pages 164 to 171 of the Annual Report of the Office of Experiment Stations for the year 1905.

cover the requirements of the institution for all purposes, including maintenance, buildings, and equipment.

REQUIREMENTS.

In considering the requirements of the Agricultural College of Utah for the next biennium, it seems necessary to call attention again to the fact that by the Federal appropriations for experimental work the cost of maintaining the College is not in any way reduced; but, on the contrary, additional funds are required from the State as a condition of receiving these appropriations. The professors in the agricultural departments, who also have corresponding work in the Experiment Station, receive part of their salaries from the Federal experimental funds; but that part of their time which is devoted to instructional work must be paid for from the instructional funds. This question has been explained in every biennial report for at least six years, but there are still people who persist in misunderstanding or misrepresenting this matter. The members of the Legislature and the people of the State should know that the $25,000 received each year from the Government, under the Morrill Act of 1890, is the only Federal appropriation which can be used in any way, directly or indirectly, for purposes of instruction.

Federal Experimental and Instructional Funds.

The following statement of the requirements of the College from the State Legislature is based upon the estimates of the heads of departments, and the report of the Secretary of the amounts expended during the preceding biennium. Detailed information regarding the items given may be had from the appended itemized statement of "Estimated Requirements." While the accompanying estimates of departments are very conservative, a reduction of $3,435 is thought practicable in the aggregate amount requested for equipment, and the following summary, therefore, includes $18,676 for equipment, instead of $22,111, as shown in the accompanying lists. It will be observed also that no provision is made for any increase in salaries.

SUMMARY OF REQUIREMENTS.

For general maintenance and equipment	$219,361	
Less estimated income	78,000—	$141,361
For miscellaneous improvements	6,235	
For purchase of live stock	5,720—	11,955
Total amount required from the Legislature		$153,316

Considering the large interests represented, and the importance of the work of the College, the above estimates are exceedingly conservative. It should not be understood that they include all the institution needs. No provision is made for any particular growth, except in the matter of attendance as very conservatively estimated. But as a matter of official duty the amounts are not placed lower than required to maintain the present standard and to do efficient work. It is not thought that the people of the State would be satisfied with less. Utah is growing as never before, and certainly cannot afford to allow the College, after all these years of healthful growth and worthy achievement, to begin now on a policy of retrogression.

Respectfully submitted,
W. J. KERR,
President.

December 27, 1906.

APPENDICES.

1. The Reports of Departments of Instruction.
2. The Report of the Librarian.
3. The Report of the Registrar.
4. The Report of the Director of the Experiment Station.
5. The Report of Farmers' Institutes.
6. The Report of the Superintendent of Buildings.
7. Itemized Estimates of Requirements.
8. A Report of the Insurance on Buildings and Equipment.
9. The Report of the Secretary.
10. The Annual Reports of the Experiment Station for the past two years.
11. The Farmers' Institute Annuals, Numbers Eight and Nine.
12. The Report of the Southern Experiment Station.
13. The Report of the Central Experiment Station.
14. The Report of the "Experimental Farms on Arid Lands."
15. The Report of the "Irrigation and Drainage Investigations.
16. A Copy of the College Catalogue for 1906-1907.

Departments of Instruction.

AGRONOMY.

To the President of the College,

Sir:—The Department during the past two years has enjoyed a steady growth, as can be seen from the increased enrollment of students in the Department. It has been found necessary and, in the writer's opinion, beneficial to make some alterations in the courses offered in Agronomy, in order to conform to the general scheme of work as it is now arranged in the Agricultural courses. The work in Agronomy 1, Soils and Farm Crops, has been made more elementary and practical, especially to accommodate students who are not trained in Chemistry, Physics, and Botany, and who expect to remain in school but a short time. This work is given to students taking the three year course, or less, in Agriculture. A more scientific and advanced course in Agronomy, Agronomy 4, is now given to all college students in Agriculture in their Junior year, after they have had the necessary training for a thorough understanding of the subject.

Changes in Courses.

Agronomy 2, Irrigation and Drainage, has been transferred to the Department of Irrigation Engineering. The Department now offers five college courses and one high school course in Agronomy, besides additional work in soils and field crops, arranged especially for the accommodation of Winter Course students in Agriculture. These courses in Agronomy 2, 3, and 4 are required of all college students taking Agriculture, while those of Agronomy 5 and 6 are required only of students taking their major in Agronomy and are elective to other students in Agriculture.

The number of students registered for work in Agriculture during the years 1903-1904 and 1904-1905, as compared with the registration of 1905-1906 and of October 11,

Students.

1906, shows a steady growth in the number of students in attendance. Not only has the number of students increased, but the grade of students is much better. This year up to October 4th, out of an enrollment of seventy-three students, there are thirty college students as compared with twenty-one for last year, out of a total registration of 108 students. And yet the per cent of college grade students last year was greater than for any previous year.

During the past summer, it was the writer's privilege to visit some of the leading agricultural schools of the country. In most instances I was agreeably surprised to learn that the grade of work being done here compares favorably with similar work of the leading Agricultural Colleges of the country. In recognition of this fact, graduate students in Agriculture from this institution, desiring to take post-graduate work in the leading Agricultural Colleges, such as those of New York, Illinois, and Iowa, will be given full credit for work done.

Importance of Work.

The popularity of the agricultural work throughout the entire country is growing. We see this growing popularity in our own institution when we note the spirit and enthusiasm that characterizes the work in Agriculture. The students registered in the Agricultural Course this year will compare favorably in scholarship with those of other schools. They are among the leaders in the College debating societies, other literary work, and athletic contests. These facts in themselves are evidence of the interest taken in the work.

The School of Agriculture is doing considerable toward the development of Utah agriculture. The leading influences in the movement are first, that the students each year return to their homes on the farms, equipped with new and more enlightened ideas as regards the proper management of the farm; second, that the winter course in agriculture at the College, given for the benefit of farmers that cannot attend for a longer term, brings the farmer into actual contact with men who are making a life study of the science of agriculture; and third, that numbers of the Station Staff, through their correspondence with the farmers of Utah and by making occasional visits over the State, are becoming better acquainted with the farmers and their needs, and are, therefore, better able to serve them.

The Department still occupies the four rooms assigned to it in the beginning, situated in the north wing of the Main Building. At first these quarters were probably all that was necessary or desired for the accommodation of the students then taking the work. This, however, is no longer the case.

Need of Room. The Department has grown until today the importance of the work in Agronomy is second to none given in an agricultural college and is therefore entitled to every reasonable consideration.

I would recommend that the following arrangements be made for the Department of Agronomy until something better can be provided:

Connect room 4, recitation room, with the adjoining room 6, the soil physics laboratory, by means of a door or archway, room 4 to be used as additional laboratory space in connection with the present soil physics laboratory, which in itself is too small to accommodate all of the students taking this work, so aditional class room will then be needed; also additional equipment and apparatus. Four working desks similar to those now in use by the Chemical Department in room 74, except that they have wooden tops, will be needed and will cost about $600. Six hundred dollars will also be required for the maintenance of the Horse Barn and for feed. Four Hundred twenty dollars will be needed for the following additional equipment:

Equipment Needed.

2 balances, analytical, to be used in delicate work with soils and moisture determinations, $110.00 each.....$	220.00
2 special ovens for heating and drying out plants and soils in securing dry matter and specific gravity of soils.....	40.00
1 microscope, compound............	100.00
Thermometers, breakers, flasks, graduated cylinders, specific gravity bottles, and other small and necessary apparatus......	60.00
Total	$420.00

All this equipment can be moved to other quarters, should it ever be necessary to do so.

The proposed laboratory arrangements above mentioned

will furnish sufficient room and equipment to accommodate 25 to 30 students, about the number we are likely to have in this work, judging from present indications. Additional specimens of grasses, grains, soils, etc., will need to be provided for the museum; and, if possible, additional museum cases. At least $400 will be necessary for this purpose. According to the proposed arrangements, a new class recitation room will be necessary. In any event, we should have a better recitation room. The one we now occupy is poorly ventilated and poorly heated, and hence unsatisfactory. If a recitation room could be arranged for on the first floor of the Main Building, as near as possible to the soil physics laboratory, it would be very satisfactory to the Department.

From present indications, all the courses in Agronomy will be called for next year. This will require ten hours' teaching the first term and twelve hours' the second term. It is impossible to do satisfactory work in farm mechanics. In order to handle this work as it should be handled, students must have access to different kinds of farm machinery. We have not the necessary machinery because we have not a suitable place to store it; nor have we a man trained in farm mechanics to teach the subject. I therefore urge that the agricultural teaching force be strengthened. One man cannot handle three or more agricultural subjects satisfactorily to himself, to the students, or to the college.

Additional Instructors.

I wish to acknowledge the valuable assistance rendered me in the work of the Department by Mr. Stephens, Assistant Agronomist.

In conclusion, I acknowledge with thanks the support that you, as President of the College, have given the work since I have been head of the Department.

Respectfully submitted,

Wm. Jardine,

Professor of Agronomy.

ANIMAL INDUSTRY.

To the President of the College,

SIR:—The Department of Animal Husbandry was placed in charge of the writer September 1, 1906. Because of the limited time in charge, this report will deal with the requirements of the next two years rather than with the work of the past. Though the number of pure-bred animals is small, demonstration work in judging, feeding, and management can be given to a limited extent. A few pure-bred stock are to be added soon and will strengthen the Department. The large barn is being completed, fitted with stalls, etc., which will give additional room, as well as provide suitable quarters for young stock.

Historical.

For instructional work in Animal Husbandry the writer would suggest giving four original courses in somewhat modified form, and offering three additional courses.

Course 1.—General course in judging, feeding, breeding and management of live-stock. Required only of short-course students.

Course 2.—Market types. The judging of market types of beef cattle, horses, sheep and swine.

Course 3.—Breed types. The judging of representatives of different breeds, according to different standards, and a study of the origin, history and development of each.

Course 4.—Breeding. A study of the laws of heredity, variation, correlation, cross-breeding, in-breeding, etc.

Courses of of Study.

Course 5.—Livestock management and study of herd books. Housing, care and management of beef cattle, horses, sheep and hogs; and a study of herd books and pedigrees.

Course 6.—Animal Nutrition. The theory and practice of feeding.

Course 7.—Advanced Judging. The judging of animals in groups such as the exhibits at county and larger fairs. Elective to students making Animal Husbandry their major.

The addition of the proposed courses will make eighteen hours credit work offered in Animal Husbandry, with some additional work to be given if the Veterinary Science course is offered.

The College at present has no buildings in which animals

can be housed during experimental feeding. For the proper handling of steers and sheep some sheds should be provided. To the south and east of the main barn is an ideal site for a cattle feeding shed; and one with a loft above and room below for about forty animals should be built. This could be used not only for experiments but for housing young animals as well.

Requirements.

A plain open shed is desirable for sheep feeding, and one should be erected near the present sheep barn. Because we have no suitable building for the work, judging is carried on at a disadvantage. Working out doors as we now do, it is hard to do satisfactory work; and during cold weather the students' health is endangered. A suitable building with a seating capacity of one hundred should be erected.

The College, as the leader in agricultural work in the State, should have herds and flocks of pure-bred animals, of the proper breeds, to be used in judging, feeding and breeding work. At present few breeds are represented on the farm, and some animals representing other breeds should be secured. Pure-bred draft mares are not common in this section, and a team could be kept with profit. A pair of Percheron mares could raise colts each year, do general farm work, and yet be available for class demonstration, and the writer recommends their purchase. The College should own small herds of Shorthorn, Hereford and Aberdeen Angus cattle, as these are the three most popular beef breeds. A Shorthorn and a Hereford bull are soon to be bought, and more cows and heifers should be kept than are now here. The Aberdeen Angus is little known in this State, but is very popular in the east. Three females and a bull would give the farm a good foundation herd.

Utah has great sheep interests and should have an extensive department devoted to this branch of live-stock. A flock of Rambouillett sheep is now owned by the College, and some Cotswolds are to be purchased. Representatives of several more of the popular breeds should be secured. Flocks of Shropshires and Oxfords could be kept with profit.

The College owns representatives of three breeds of swine, Poland China, Yorkshire and Tamworth. New blood should be secured by purchase of a boar of each of these breeds. Some Berkshires should be secured, as this breed is the most popular one in Utah.

	Cattle sheds and yards	$1,200	
	Sheep shed and yards	400	
	Stock judging pavilion	1,500	
	Fences	250	
	Completing bull paddocks	100	
	Water troughs and piping to yards	250	
	Building boar yards and individual houses	150	
	Trees for pasture	25	
	Books for library	75	
Equipment Needed.	Card index cases and livestock pictures	35	
	Team of Percheron mares and harness	1,000	
	Shorthorn females	700	
	Hereford females	600	
	Aberdeen Angus bull	300	
	Aberdeen Angus females	600	
	Shropshire ram and ewes	175	
	Oxford ram and ewes	150	
	Tamworth boar	35	
	Yorkshire boar	35	
	Berkshire boar and sows	125	
	Herd and record books	35	
	Total		$7,740

	Salary for livestock assistants	$2,500	
	Feed for stock	2,000	
Supplies.	Incidentals, halters, ropes, building repairs, etc.	600	
	Registration of live-stock	50	
	Total		$5,150

Respectfully submitted,

JOHN T. CAINE, III.,

Assistant Professor of Animal Husbandry.

DAIRYING.

To the President of the College,

SIR:—Previous to September 1st, 1906, the Dairy Department was combined with the Animal Husbandry Department. As dairying has so recently been made an independent department, this report shall include little of the past. It shall deal largely with present conditions and plans and needs for the future.

The work of the Dairy Department may briefly and conveniently be grouped as follows:

Scope of Work.

I. Instructional.
   1. College.
   2. Extension.
   3. Correspondence.

II. Experimental.
   1. Economic milk production.
   2. Manufacture of dairy products.

III. Management of the creamery and of the dairy herd.

The dairy instructional work covers the various phases of breeding, feeding, judging, and caring for dairy animals; the economic production of milk, and the manufacture of dairy products on the farm as well as in the factory.

The following dairy courses are now offered: Dairy 1, Farm Dairy Products; Dairy 2, Dairy Cattle (their feeding, breeding, judging and care); Dairy 3, Inspecting and Testing of Dairy Products; Dairy 4, Operation of Creameries; Dairy 5, Cheesemaking; Dairy 6, Technology of Milk; Dairy 7, Dairy Bacteriology; Dairy 8, Research Work; Dairy 9, Thesis; Dairy 10, Dairy Practice.

In the short courses the points of most practical value are given.

In order to give thorough instruction, to inspire interest in the students, to have equipment in keeping with the importance of the dairy industry, and to set a good example, better facilities and more equipment are needed.

Needs.

The creamery is too small. Its location is such as to make light and ventilation poor; and conditions prevent the installment of modern equipment and hinder economic operation. The refrigeration is poor and unhandy. On this account experimental work is handicapped. A new dairy building in which the va-

rious laboratories, class rooms, and offices can be located, is greatly needed.

The college creamery will receive on an average about 1,600 pounds of milk daily for which about $13,300 is needed. The income from this will be about $14,000. For creamery supplies, ice, coal, salt, color, butter and cheese packages, testing apparatus, etc., about $700 is needed.

A new boiler is needed in the creamery. The present one, in addition to being too small, is badly worn. Five hundred dollars will be required for this purpose.

The dairy herd needs to be enlarged, and a better quality of individuals should be bought. For various reasons good representatives should be had of at least the three leading dairy breeds, Jersey, Holstein and Guernsey. The writer would recommend that money be appropriated for buying pure-bred registered dairy animals, consisting of three young Holstein cows and one Holstein bull; three young Jersey cows and one Jersey bull; and two good Guernsey cows. The estimated minimum cost of these animals is $2,000.

The College should produce as much milk as possible consistent with all other conditions. The Cache Valley Milk Condensers are paying such high prices for milk that it is difficult for the Department to secure milk at a reasonable rate for experimental and instructional work.

Some funds are needed for the fencing and building of yards for dairy calves, so that they may have exercise and fresh air. This will require $200.

Herd and record books are also needed, so that a correct and complete account of all dairy animals and their feed can be kept. These items could be purchased for $25. Fifty dollars should be provided for registration of pure-bred dairy animals.

Silo.

A silo is also needed. Corn fodder can be successfully grown in Utah. Experiments conducted by the Utah Experiment Station previous to the year 1891 indicated that for steers and sheep it was not profitable to store corn fodder in the form of silage under the then prevalent conditions. So far as can be learned, silage was not tried as a food for dairy cows. Dairy cattle especially need a succulent food during winter, and it is for dairy cattle that silage excels. That silage is a cheap, healthful and economic feed has been demonstrated beyond doubt in the east, where it is used successfully in large quantities.

At the time the experimental results pertaining to the feeding of silage to steers and sheep were obtained, conditions were different from those now existing. Pasture was more plentiful, and land, hay and all kinds of roughage were cheaper. Under the present conditions, large farms have been divided up into smaller ones, more intensive methods of farming are in practice, and, as a consequence, each man has less pasture. Silage is excellent feed for cows during fall and spring shortage of pasture. Lucern and good hay are now high in value, and it is the opinion of the writer that silage for dairy cattle is an economic feed under Utah conditions. He therefore recommends $250 for silo.

The writer hopes that provision will be made for a place in which students may judge dairy stock.

Few suitable text books are available for dairy students. On this account prepared notes and lectures should be given the students as references. The writer would recommend $90 for covering expenses involved in copying such references. A suitable fee could be required of the students, which, in a measure, would cover the above expenses.

Conditions are rapidly approaching in the state of Utah when the most intensive methods of farming need to be practiced. Population is increasing, farms are becoming smaller, land is higher in value, and living more expensive. In connection with sugar beet, fruit, lucern, and wheat raising, various products need to be converted into a more concentrated, refined and profitable article, without removing the fertility of the land.

Extension Work.

According to experimental evidence, the cow is by far the most economic producer; this in practice is further emphasized by the existing conditions in densely populated countries.

Extension work needs to be carried on for these reasons. First, in order to emphasize the naturally favorable conditions for successful dairying in the valleys of Utah, and also to emphasize the economic aspects of dairying when practiced in connection with the now existing profitable methods of farming. Second, to aid the farmers in keeping more profitable cows. In order to accomplish much in this line, test associations should be established whenever conditions permit. This would encourage organization and co-operation, and the productiveness of the cows would be ascer-

tained. Third, suggestions relating to dairy problems in general should be given whenever conditions demand it.

If the work along the lines mentioned above is taken up conscientiously and judiciously, greater interest in profitable dairying cannot fail to result.

The writer would recommend that $1,000 be appropriated for dairy extension work. This money would be used for establishing cow test associations, for buying such apparatus as may be needed in connection with the work, for charts and maps and circulars of dairy information, and for traveling expenses.

Correspondence.

Much dairy information is imparted through correspondence. Since such information is usually given to parties who are in immediate need of it, who cannot attend college, and to whom it does the most good, it should be encouraged. The writer would recommend that $100 be appropriated for stationery.

Labor and Management.

At the present time, student help is employed in the creamery. Considering the kind of help, this is good, but it is impossible for a student, whose interest largely centers in college studies, to do his best in the departmental work. It would cost very little more to employ one who would give all his time and efforts to the work of the Department. The creamery is now receiving daily, except Sundays, a load of milk from Greenville. To pay milk-condensing prices to the farmers and to manufacture the milk economically into butter and cheese, demands the best labor and management. The writer believes it would be economy to hire such and would, therefore, recommend that a competent and permanent assistant be hired at a salary of $70 per month. This would also enable the head of the Department to devote more of his time to experimental work.

For labor in the barn (milking, feeding, and caring for dairy animals) the writer would recommend an appropriation of $900, the Experiment Station to pay for the remainder of help needed.

Income.

Figuring on the present basis, the income from the creamery will be about $14,000. The income from the dairy herd will amount to about $1,000. The total estimated income will then equal $15,000. The College herd is now largely composed of young stock which during the next few years, until maturity is reached,

will reduce the income. If pure-bred cows are purchased the income from the herd will be materially increased.

Supplies.

Creamery assistant at $70 per month	$1,680	
Milk for creamery	13,300	
Creamery supplies (ice, coal, salt, color, testing apparatus, etc.)	700	
Estimated income from creamery (butter, cheese, etc.)		$14,000
Labor	900	
Herd books, record books, score cards and blanks	25	
Registration of pure-bred dairy cattle	50	
Stationery, stamps, index cards, etc.	100	
Labor and supplies needed for extension work	1,000	
Estimated income from dairy herd		1,000
Feed for dairy herd	1,000	
	$18,845	$15,000
Total amount needed		$ 3,845

Equipment.

Silo		$ 250	
One boiler in creamery		500	
3 Holstein cows and 1 bull	$800		
Three Jersey cows and 1 bull	800		
2 Guernsey cows	400	—2,000	
Building yards for young dairy stock		200	
Building milk-receiving platform		40	
Improving ice house and refrigerator		175	
			$ 3,165

Total supplies	$3,845
Total equipment	3,165
Grand total	$ 7,010

Respectfully submitted,

C. LARSEN,
Professor of Dairying.

POULTRY MANAGEMENT.

To the President of the College,

SIR:—The Poultry work has made some progress during the last two years, but as it was in charge of another man, I am unable to make a report for the two years in question. I may say, however, that considerable experimental work, covering questions of feeding for egg production, and some lines of incubation, has been in progress, though not yet reported. Some poultry instruction has also been given.

Historical.

As to the needs of the Poultry work, the following statement covers most of the expenditures that will be necessary during the next two years, outside of the usual running expenses:

The most urgent need of the Poultry work is about a dozen small colony houses for the growing stock during the summer and also for use in winter for experiments with laying hens. These will cost in the neighborhood of $175. A small house for geese and another for ducks, costing about $25 each, are needed.

Requirements.

More fencing should be built. All the ground set apart for the Poultry Department should be enclosed with a poultry fence. This fence should extend south from the poultry house to the first fence and east far enough to take in at least five additional acres. Some other fencing will be required inside of this enclosure to separate different flocks of chickens. This fencing will cost in the neighborhood of $200.

With these fences we will be better able to take care of the fruit trees and some shade trees that should be planted. The chickens need shade and it has been proved that fruit trees sometimes need the chickens. Poultry and fruit make a very profitable combination. I would recommend that about 200 trees of some good varieties of apples, preferably winter apples, be planted in the spring, and possibly some plum and cherry trees. The land, I believe, is well suited for such trees, and we can make this an instructive exhibit of poultry and fruit culture.

A windbreak of trees along the eastern boundary of the poultry farm would be an advantage for two reasons: first, to break the force of the canyon winds against the poultry houses and thus obviate to some extent the danger of sickness in the flocks caused by exposure to winds and draughts. It would also catch the snow and lessen the amount that would collect around the houses. Second, the windbreak would be a decided advantage in protecting any fruit trees that may be planted. This wind-break should be largely of evergreen trees interspersed with some quick growing trees, such as box-elder, catalpa or locust.

A few evergreens set in front of the main poultry house would add to the attractiveness of the place. There should also be a few trees around the duck pond. The trees and tree planting will cost $100.

An incubator cellar should be completed for early spring work. For $500 we can probably build what we need. The main need for the incubator cellar is in the experimental work. We are planning extensive experiments in incubation and brooding under the Adams fund. The cost of these experiments will be charged to this fund, but the buildings will have to be paid for out of the State funds.

The need for careful investigation of the problem in incubation and brooding is very great. It is here that most of the troubles in the poultry business originate. Millions of chicks die every year as a result of improper methods of hatching and brooding, and millions of the chicks that do not die survive with impaired vigor. It is safe to say that the losses from this one cause in Utah alone run up into the thousands of dollars. It is surprising to note the number of incubators and brooders that are purchased.

A great many intricate questions are involved in incubation experiments, and it would take a generation of time with only two or three incubators to work with to reach any conclusions of value. Quick work is needed as much as careful work. The Utah Station has made a good beginning in this work, and we should continue it to its final conclusion.

Value of the Work.

One of the most prominent incubator manufacturers in the United States, in a private letter to me recently, said: "We do not know whether you know it or not, that your bulletins and ex-

periments that you conducted at Logan, Utah, on the effect of carbon dioxide upon the shell, have attracted a great deal of attention among leading experimenters in artificial incubation. . . . The first time we read your bulletin, we thought it was a piece of foolishness, but having exhausted apparently every other field in our experimental work, we turned to the carbon dioxide, etc."

The Utah Station was the first station to take up poultry investigations. Since our work was started, nearly every Station in the country has taken up the work, and it is generally conceded that the results of our experiments have had a potent influence in arousing a greater interest in the industry and in encouraging better methods in poultry keeping. So great has been the interest in our experiments that though large editions of our bulletins were published, they were very soon exhausted. These bulletins have been published and republished in poultry and farm papers in every state of the Union, and in foreign countries. The Station and State have been given unstinted credit for its work in this line. A few hundred dollars expended in investigation work may mean millions of dollars to the poultry industry of the country.

It is difficult to say what the money worth is of the poultry and eggs produced in Utah. The U. S. census of 1899 valued the product at some $700,000, but this did not include the amount produced in cities and towns, which is very large.

The United States Department of Agriculture placed the value of poultry products in the United States last year at $500,000,000. If they were divided among the states on a basis of population, Utah's proportion would be about $2,000,000. On that basis $1,500,000 would be a conservative estimate of Utah's poultry production. There is no reason why, with improved methods, this amount could not be doubled. Improved methods will come only through careful and complete investigation work.

The importations of poultry and eggs into Utah are very large, amounting to over a hundred thousand dollars per annum. This money, if kept at home, would more than pay the state tax for maintaining the Agricultural College. Instead of complaining about the cost and allowing Kansas to maintain her Agricultural College on the money received from Utah for poultry and eggs, why not keep a few more hens, give them better care, and loyally support our own institution.

Summary of Needs.

Colony houses ....$	225
Fencing	200
Fruit trees and planting.......	100
Incubator cellar	500
Total	$1,025

Respectfully submitted,
JAMES DRYDEN,
Professor of Animal Industry.

VETERINARY SCIENCE.

To the President of the College,

SIR:—This Department was put in charge of the writer in August, 1905. The equipment that could be found was quite limited, old and out of date, besides being poorly cared for. It had been purchased during the first years of the College and nothing new had been added. There were four courses offered in Veterinary Science until this year. The enrollment of last year was very good in the general courses, as well as in the winter course. Students were all enthusiastic and did excellent work in all the classes. Prospects for the future of this course are very promising, many of the students asking for additional work along this line. The increasing numbers of students, the demands and inquiries for work in Veterinary Science, have caused seven courses to be offered, as announced in the catalogue, with the hope of having full courses in Veterinary Science leading to a degree offered in the near future.

Historical.

The weekly free clinics held at the hospital have been well attended. About 200 animals have been operated on, treated, or prescribed for, these animals having been brought from nearly all parts of the surrounding country. At these clinics the students can observe and apply what they learn in the class room.

Since taking this work, about $250 has been expended for procuring the most necessary equipment and supplies. Some

changes, as far as means would allow, have been made in the hospital.

Owing to the increase in attendance the class room used for Veterinary Science is not large enough; besides, the room is poorly lighted and poorly ventilated. We also need more room at our hospital for sick animals. We require additional equipment and supplies in order to carry on the work successfully. The operating table we have should

Requirements.

be entirely overhauled, or a new one of modern style procured. The constant demands for such an appliance in performing operations renders it absolutely necessary. We need specimen jars to keep histological and pathological specimens and a place to put them.

More books and periodicals are needed in the Library on Veterinary Science. If the enrollment continues to increase, as it undoubtedly will, in order to attend to the duties of this Department, an assistant will be necessary. In no branch of study is farmers' institute work more necessary than in Veterinary Science. The ignorance that exists in many parts of the state in reference to treating ailing or diseased animals, or controlling infectious diseases, is appalling. Methods of preventing and controlling, as well as treating animals, need to be discussed in all parts of the State. Having no assistant, our class work is more or less neglected while I am away on such trips. However, the amount of good derived by the different localities is beyond estimation, and such work should be done wherever it is possible.

It is with pleasure that we note that Veterinary Science is receiving its full share of the prosperity of this country, and the people of this and surrounding states are beginning to see the importance of this profession. A strong demand is made for well educated veterinarians who can put their knowledge into practice; they are earnestly sought after. There is probably no profession that is so certain of giving good returns as soon after graduation as this one. There is a clamor for veterinary education even in this state. Numerous inquiries about such a course have been and are being made from different parts of this and surrounding states. They are all desirous of knowing whether they can

School of Veterinary Science.

get a course at the Agricultural College of Utah, leading to a degree, or where we would advise them to go. There is no veterinary school west of Kansas City, Missouri, and the ones located

there are private institutions. A person desiring such an education and wishing to master the same, always selects a state institution or one affiliated with such a school in preference to a private institution. A School of Veterinary Science will certainly be established in this intermountain country. It has been plainly demonstrated that private institutions which depend on tuition for maintenance do not as a rule maintain the high standard of institutions supported by the state or government. The Agricultural College being so endowed as to render it independent of fees for its support would ask only high attainments of its students. A course should be established in our College leading to a degree and requiring four years of college work.

Such a course would not be a great expense to the state. The principal cost would be the teaching force, and this would not be needed for two years, with the exception of an assistant. True we would need more equipment for our hospital and class rooms, but the present equipment must be increased whether we have this course or not. Students in Veterinary

Extra Requirements.

Science would have the benefits of all the facilities offered by the various departments of the College aside from the facilities which would belong especially to the Veterinary Department. The work in Bacteriology, Animal Husbandry, Zoology, Chemistry, Botany and related studies, are already provided for in the several departments of college work and would, therefore, not need to be created and maintained separately; hence a great part of the work is already offered.

Situated as we are in the center of one of the greatest livestock regions of the West, the animals of this section would furnish the best of opportunities for securing all the cases desired for clinic and hospital work. Daily free clinics would be held and the students would get the practical work each day, applying the knowledge gained in the class room.

Advantages.

Added to this would be other opportunities on the College Farm with its breeding establishments for horses, cattle, sheep, hogs and poultry, furnishing rare advantages for students, which can only be had in connection with enterprises of this nature. We recommend, therefore, that this proposition be carefully considered as it will mean much to this state and the institution prescribing such a course.

The following is an estimate of expenditures for two years, providing the course is established:

Expense Involved.

Making changes at the hospital.	$ 150
Large new shed with stalls for patients	950
Equipment of hospital and instruments	750
Museum supplies	100
Department supplies, drugs, etc.	800
Total	$2,750

Besides the regular class work and the clinics, much time is spent in caring for our farm animals in the way of preventing, eradicating, and treating them, and in preparing and applying medicines or giving instruction for their application. We have kept everything in check up to date. Aside from these duties we have an extensive correspondence from all parts of the state, asking advice, and we often get urgent calls to investigate different contagious diseases, but time and means at our disposal will not admit of personally investigating all of them. There being no State Veterinarian, the College is the only recourse the people have.

State Veterinarian.

This state is badly in need of a State Veterinarian. The livestock interests, which are among the foremost, demand attention. Owing to the importation of better breeds and the more intelligent methods of breeding, the domestic animals are yearly becoming more valuable. There have been thousands of dollars lost in the past from contagious diseases, owing to the lack of knowledge of how to control and eradicate the same. Therefore, it naturally follows that outbreaks of contagious diseases will in the future, if not controlled, entail far greater loss than in the past. Not only are these diseases transmitted from animal to animal, but also from animals to man, thus endangering human lives. Unless something is done in this regard, our state, which has been practically free in years past from such contagion, will be as badly infested as some of the eastern states. We are called out occasionally by the State Board of Health to investigate such outbreaks. This work is not legitimate College work, unless some understanding is had between the Institution and the State.

According to the Year Book of the U. S. Department of Agriculture for 1905, Utah contains:

1,384	horses, valued at	$4,816,185
3,096	mules, valued at	137,415
74,430	milch cows, valued at	2,456,190
256,844	other cattle, valued at	4,110,783
2,625,401	sheep, valued at	8,329,085
60,188	swine, valued at	418,307
	Total value	$20,267,965

When we consider the magnitude of the livestock interests of this state and the almost entirely unprotected condition of this industry, we cannot help but see the importance of education along this line. There is a present ratio in the United States of three farm animals to each human being, and less than one veterinarian for each ten physicians. In Utah the ratio would be much greater. We are safe in stating that there are fewer veterinarians in this State than in any other state in the Union, and nowhere are better openings. I give these figures and statements to illustrate the need of a school of veterinary science in this state, and the necessity of creating the Office of State Veterinarian.

Utah's Livestock.

The diseases most prevalent and called to our attention most frequently are tuberculosis, contagious abortion, glanders, symptomatic anthrax (black-leg), cerebo spinal meningitis, hog cholera, lumpy jaw, mange, influenza, distemper and cases of poisoning. We have ample proof that some of these diseases can be and are transmitted to human beings through contact, as well as by the use of diseased meat and dairy products. This work could be efficiently performed and looked after by the Veterinary Department of the College and the Experiment Station at the least possible cost and for the best good of the State.

Diseases.

The Veterinarian should be empowered with the authority to quarantine, condemn, and have slaughtered animals suffering from a contagious disease, and see that such premises are thoroughly disinfected and thus check the spread of infectious diseases. In many states the Professor of Veterinary Science of the state college is State Veterinarian. This

should be inaugurated in this state. Such a supervision in connection with proper legislative enactment would provide a protection to human lives, as well as to the livestock interests of this state.

Requirements.

Changes at the hospital.......	$ 100	
Equipment, instruments, etc...	575	
Charts, models, etc..........	150	
Museum glassware, specimens.	75	
Supplies, drugs, medicines, etc.	475	
Total		$1,375

Respectfully submitted,
H. J. Frederick,
Professor of Veterinary Science.

HORTICULTURE AND BOTANY.

To the President of the College,

Sir:—I herewith respectfully submit, for the Department of Horticulture and Botany, a report of conditions for the past two years and a statement of the requirements for the next biennium.

Historical.

Previous to my accepting the position as head of this Department, two years ago, there had been several men in charge of the work, each for a short period of time. None of them had remained in charge long enough to get closely in touch with the requirements of the position and the work of the Department, either as regards his Experiment Station duties or the teaching in the College. Consequently, the Department was not occupying the place in the institution which the importance of horticultural work in Utah would justify its occupying.

I found that the courses of study outlined were incomplete for a proper presentation of work upon plants, if students should desire to specialize in this Department. In Horticulture there were but seven courses offered, in Botany but two. Moreover, only one course of Horticulture was required of agricultural students, and though both courses in Botany were required, there was no opportunity given them to go deeper into the study of plants—the basis of agricultural work. The one small greenhouse which was at the disposal of the De-

partment was used entirely in the housing of decorative plants for the College and in propagating plants for experimental purposes, the work room being too small to be of value as a laboratory.

With opportunity for handling large classes limited, there were but few students desiring to take the work in the Department. However, the horticultural interests of Utah showed such wonderful promise that it seemed wise to so arrange the courses and increase the facilities for handling them to such an extent that instruction intended to promote the industry could be given. To this end the courses of study in the Department were altered and increased.

New Greenhouse.

Now, however, we have a new greenhouse of suitable size to serve as a student house and therein will be conducted experiments by the students of a nature calculated to instruct them in various lines of plant physiology. The work room has also been materially increased by the erection of a suitable building containing storage cellar and attic in which a large amount of the material used by the Department can be kept, besides furnishing a very handy room for student work. Benches are provided around the room, which is of a desirable shape and well-lighted. There are eleven drawers which are provided for student use, each of which will be fitted with the various tools necessary for such work. This arrangement is a very great improvement over the past, and will result in considerable value to the Department.

Change in Courses.

To the previous seven courses in Horticulture, there were added four lines of advanced work; and to the courses offered in Botany, two additional courses, designed for students desiring to specialize in plant physiology and pathology, were added. Aside from these additional courses, which are elective, the regular courses of required work have been changed considerably. As has been mentioned, there was but one elementary course of Horticulture required of agricultural students. To this has been added two courses, one in Pomology and one in Olericulture, which are required of all students who graduate in the Agricultural School.

The three year course having been changed, to better adapt it to the needs of the class of students working therein, has also required the changing of the courses in Botany. This has more than doubled the number of students taking that work.

Last year in both Horticulture and Botany there were fewer than fifty students in the required courses given. This took an equivalent of only nine credit hours in the class room for the school year. This year, with our registration still incomplete, at this date we have enrolled one hundred and twenty-five students, in nine courses, which will require the equivalent of twenty-three hours in the class room for the school year.

Additional Assistance.

In this connection I desire to call attention to the large increase in Experiment Station work which this Department has been obliged to perform during the past biennium. Two years ago the Legislature turned the Southern Experiment Station over to the Agricultural College for administration. They also provided for the Central Utah Experiment Station, which is now completing its first year of work. Both of these Stations are horticultural in nature and, therefore, come largely under the care of this Department. In each case, considerable general supervision is required as well as attention to the details of the work. Horticultural work has also been started at the Juab County Arid Farm, while work of the same nature has been considerably increased at the home Station. Before this increase in Experiment Station work, with less than one-half of the teaching now required of me, my time was completely taken up. Nor was I then expected to do as large an amount of institute work as at present. I find under these circumstances that it is impossible for me to maintain as high a standard of work as would be desirable in a school of this grade, and, therefore, I respectfully urge that the matter of granting assistance in this Department be carefully considered.

The horticultural class room and laboratories are so high in the main building that they often are quite inconvenient. This is particularly true of the botanical laboratory which seldom has sufficient pressure in the water mains to cause a flow. This seriously interferes with laboratory work, and should receive early attention.

Campus.

As regards the campus, the care of which also comes under this Department, there has been considerable improvement during the past year. Several new drives have been laid, new lawns made, and shrubbery planted. There has also been started in the garden a small nursery of ornamental shrubs, principally of species not

before grown in Cache Valley, which are being tried out with the intention of propagating and planting them on the campus, if they show desirability.

The new plantings which have been made are continually adding to the beauty of the grounds, and will do so in the future if the plans now in mind are carried out. There are, however, no great changes contemplated. The work of the next two years will be mainly that calculated to keep the grounds in good,clean condition and the addition of those plants largely used by landscape gardeners; thus giving more material for the use of students studying that branch of horticulture, as well as being of considerable profit from the standpoint of beauty and sales of plants propagated.

The expense of carrying on the work of the Department under the plans outlined, including the assistance, which is imperative, will not be greatly in excess of that for the past two years. We give below a brief estimate of funds needed for carrying on such work.

Labor.	Labor on campus	$1,200—	$1,200
	Horticulture:		
Equipment.	Laboratory apparatus, spraying outfit, scales, microscopes, flower pots, electric battery, etc.	350	
	Campus:		
	Tools, hose, lawn mower, etc.	510	
	Botany:		
	Laboratory apparatus, microscopes, slides, balances, etc.	975—	1,835
	Horticulture:		
Supplies.	Laboratory materials, seeds, bulbs, trees, shrubs, coal for greenhouse, etc.	535	
	Botany:		
	For class room work	90—	625
	Total for year		$3,660
	Total for two years		$7,320

Respectfully submitted,

ROBT. S. NORTHROP,

Professor of Horticulture and Botany.

IRRIGATION AND DRAINAGE.

To the President of the College,

SIR:—Irrigation and Drainage, embracing as they do in our Arid Domain the very foundation of economic agriculture, have grown to such an extent that it has been advisable to create a department for these subjects; hence, at the beginning of the present fiscal year, the Department of Irrigation and Drainage came into existence.

The subjects of Irrigation and Drainage are so closely related that a comprehensive study of one involves a discussion of many of the principles of the other. In view of this condition, the courses offered include both irrigation and drainage.

Courses.

Course 1, required of Sophomores in Agriculture, is designed as a practical course of such phases of Irrigation and Drainage as will be encountered upon the farm by the agriculturist of the State. Liberal use will be made of bulletins treating upon these subjects and copious reference made to the work of the Experiment Station, so that a student having finished this course will have the foundation for the most economic use of water and the principles of farm drainage for the removal of surplus water and alkali.

Course 2 is designed for such students as desire special training in the use of irrigation water in its relation to plant growth and to soils; canal management and construction; the development of irrigation water supplies, and water storage: together with the problems of drainage as involved in the removal of water and alkali from a more or less extended district. Elective to Seniors in the Agricultural course.

Course 3 was arranged for students desiring to specialize in Irrigation and Drainage, and especially to meet the requirements of the Federal Government and western experiment stations for workers along this branch of agriculture.

A special course of lectures will be given by the Department in the winter course in Agriculture, discussing the various practices of irrigation and drainage with a view to a better use of irrigation water and practical farm drainage.

Numerous field excursions are a prominent part of all courses in this Department.

I would like to call your attention to the fact that Utah, through the work of the Experiment Station, is recognized as one of the leaders, in the science of Irrigated Agriculture, both by other Experiment Stations and by the U. S. Department of Agriculture. The moneys appropriated by the State and by the Federal Government for this work, together with the additional state appropriation of two years ago for drainage investigations, have resulted in a fund of practical and scientific information upon these subjects, which information will be used in the class room work of the Department.

Federal and State Co-operation.

Thanks to the excellent equipment of the Experiment Station and the varied practices in irrigation and drainage in the immediate vicinity of the College, the needs of the Department are few. It is desirable that each student perform some individual experiments. The material for the work can be procured for perhaps $100 per year. It is also desirable to have a few additional works of reference which can be secured for about $50. With these additions the Department will be equipped to do thorough practical work in Irrigation and Drainage.

Needs.

Respectfully submitted,

WALTER W. MCLAUGHLIN,

Professor of Irrigation and Drainage.

DOMESTIC SCIENCE AND ARTS.

To the President of the College,

SIR:—The School of Domestic Science and Arts has made the same satisfactory progress during the past two years that has characterized its growth since it was first organized. Each year shows an improvement in courses of study and in methods of instruction, as well as in class rooms, laboratories, equipment, and general facilities for giving instruction. The quality of the work done by the pupils is steadily improving, as we have better means for giving instruction and as they come to us better prepared for their work.

Historical.

The readiness with which our graduates secure positions as instructors in Domestic Science and Arts shows the esteem in which the work of this school has been held by the public

during the past two years. At the present time, the Domestic Science and Arts Department of the Agricultural College of Utah is represented by its graduates in the University of Utah, the Latter-day Saints University, the Brigham Young College, the Snow Academy, the School for the Deaf and Blind, the Manti High School, the Nephi High School, the Ricks Academy, the Fielding Academy, the Oneida Stake Academy, and the New Mexico College of Agriculture and Mechanic Arts. Besides these places mentioned, five or six of our graduates are employed as instructors and assistants in our own school.

The Domestic Science course has been materially strengthened along the lines of its technical work by the addition of three credit hours in the Sophomore year. New features had been added in the Freshman year until it was over-crowded. Too much work was required for the credit allowed. The removal of the science of nutrition, dietetics, and the serving of the individual dinner to the Sophomore year is a change greatly appreciated by both instructor and pupils. This change necessitated the removal of Botany 2 and Floriculture from the course. While this was to be regretted, we believe the added work to be of greater value to the young woman than the work removed. A slight change has been made in the Junior and Senior years that distributes the technical work more uniformly through the course.

Changes in Courses.

The standard of admission to the manual training course has been raised. An eighth grade certificate is now required for admission unless the individual is over eighteen years of age. This new rule has excluded but one individual at this writing. There have been but few applicants for admission over eighteen years who have not passed the eighth grade studies.

The classes in practical cookery have been conducted very successfully byMiss Fisher, aided by two student assistants. As in previous years, the aim is to make the work of the greatest possible practical value. The students work individually, each one preparing the dish that constitutes her lesson in sufficient quantity for a small family. The cost of each dish is figured out from price lists furnished the students. The preparation of large quantities of food necessitates a sales department, which greatly increases the work of the instructors in this department, but we believe the added value to the pupil

of this practical training more than compensates for the added work and the increased expense.

The practical work recently added to the courses, viz., the individual serving of teas and dinners, has proved very successful, and its practical value to these future housekeepers is beyond estimate. In this work a given sum of money is allowed for a given number of guests, and the student plans, purchases, prepares and serves the best meal possible within these limits. Two dollars is allowed for a five course high tea and $3.50 for a six course dinner. In each case food is allowed for ten persons. No feature of the cooking course is more highly appreciated by the students than this. New features are constantly being added to all the lines of practical cookery.

In the laboratory new gas burners and some new equipment have added to the usefulness of the room. The food museum has received numerous additions and is a great aid in teaching the classes in composition of foods. Most of the material in this museum has been contributed by various firms and hence the only expense to the College has been the purchased cabinets and bottles. A general household science museum would be of great value and a small sum expended each year would soon give very valuable aid to class instruction. A collection showing the different grades of pottery and table dishes is desirable and would not be expensive. In the kitchen laboratories and pantries new floors, fresh paint, and neatly white-washed walls make these rooms as attractive and comfortable as it is possible for them to be, but they are still, as they have always been, too low to be well ventilated and too dark on short winter days for the comfort of the afternoon classes. As well as more room for the laundry classes, another kitchen is needed.

Equipment.

The usual expenditures have been made to replace worn out and broken cooking utensils and kitchen linen. The dining room needs some refurnishing and painting. The floor and wood work is too dark for a room with so little light. The walls should be tinted. Better chairs and a good sideboard are desired. Some very desirable Irish table linen has been purchased and more will be needed next year, as the old supply is too thin for constant use. Five dozen of the heaviest Reed and Barton plate teaspoons, neatly engraved with "A. C. U.," were purchased direct from the factory. This is the first silver that has been purchased for a number of years. More will be required next year. Some new fancy table ornaments, cut

glass pieces, candelabrums, doilies, etc., were donated to the department by the pupils from profits on ice cream and cake sold to the students at lunch hour.

An unusual amount of entertaining has been done in the Department this last year, which has greatly increased the work of the instructors, as well as the expenses of the Department. In all these cases, extra help has had to be employed in washing dishes and in cleaning, and laundry bills have been considerably increased. We feel that this entertaining is helpful in giving the public a knowledge of the work of the Department.

Domestic Arts.

The Domestic Arts Department continues to give instruction so valuable and popular that the rooms are crowded with students at nearly all periods of the day. Many new features, which increase the practical value of the work, have been added to the course in sewing. The pupils in dressmaking work cut out in paper the designs they have selected for their gowns before cutting the cloth. This preparation ensures economy of material and enables the pupil to make any desired change in the style before the goods are cut.

A collection is being secured for the textile museum to show variations in quality and price of standard goods. The instruction thus given will enable the students to distinguish between good and poor material. A small amount of money should be set aside each year to increase this collection and add other desirable features to the textile museum. A collection should be secured showing the processes of manufacturing goods from the wool fiber. It has been decided that the fashion periodicals in the sewing rooms shall be purchased from the Department funds instead of from Library funds, as heretofore. A great amount of work has been done in the Domestic Arts Department in preparing exhibits for the fairs at St. Louis and Portland, but we feel that the hard labor has been amply compensated by the honor and distinction that has come to the College through our school of Domestic Science and Arts. Our exhibits received the highest awards—the gold medal—and that in competition with similar departments in all the other land-grant colleges.

The following is an estimate of the requirements for the next biennium:

Equipment.	Cabinet for household economics collection, laundry tubs, desks, tables, chairs, linen, silver, china, etc.	$ 672
Supplies.	For cooking classes, laundry, extra help in kitchen, etc.....	1,950
Equipment for Domestic Arts.	Carpet, sewing machines, chairs, tables, cabinet, etc.	472
	Total	. $3,094

Respectfully submitted,
DALINDA COTEY,
Professor of Domestic Science and Arts.

COMMERCE.

To the President of the College,

SIR:—The wisdom of the founders of the Agricultural College of Utah in adhering strictly to the original spirit and purpose of the land-grant colleges, is shown in the second biennial report of the Board of Trustees. President McCornick says: "In consonance with the idea embodied in the law, and with the tendencies of modern thought, it was decided to organize five distinct courses of study, namely: Agriculture, Mechanic Arts, Civil Engineering, Domestic Arts, and Business, representing the five great avocations."

Value of the Work.

It cannot be denied that commerce is the "dynamic force" of modern civilization. There was a time in history when man was employed chiefly in hunting and fishing and in the production of such raw material as was absolutely necessary for his existence. When population became too dense and want too pressing, wars of extermination were the quickest means of relief. But as civilization advanced and as wants of man multiplied, two very important factors entered into the industrial problem—manufacturing and commerce.

Agriculture, horticulture, forestry, and mining deal with the production of raw material. The mechanic and domestic arts deal with refining raw material; while commerce, in its various phases, deals with the exchange of marketable pro-

ducts. The importance of this last factor in the industrial problem is often lost sight of, and it has been only recently recognized that the training of an intelligent class of men and women for the purpose of facilitating the exchange of products between individuals, states, and nations, is a duty of the state as important as the training of scientific agriculturists and mechanics. Most of our States have realized this duty, and have not been slow in introducing commercial courses in their public schools, and in their higher institutions of learning. The importance of a thorough commercial training has been further emphasized by a general realization of the fact that there is a business side to every vocation. Other things being equal, the farmer who conducts his affairs on strict business principles is by far the most successful.

A thorough business course consists of more than a study of bookkeeping and penmanship. Thorough courses in languages, mathematics, the natural sciences, economics, and political science, are quite as important. Hence the advantage of incorporating business courses in the curriculum of the higher institutions of learning where courses in the basic subjects referred to are already established. Where this is done, as is the case in this institution, the additional cost per student for the technical courses is exceedingly low.

Historical.

As stated in my last annual report, thanks to your favorable consideration of my recommendations, the Commercial Department may now be said to be almost completely equipped. The additional equipment required during the next two years will depend largely upon the growth of the classes in Typewriting. Increased demand for male stenographers has increased the attendance in these classes to such an extent that enlarged facilities must be provided should the classes continue to increase.

The excellent equipment of the Commercial Department has been provided at a cost very much lower than was at first estimated. Thus, Professor Burchell estimated the expenditures for equipment and supplies for the years 1903-1905 at $3,600, while only $1,455.84 was expended; and my estimate for last biennium was $1,020, while not quite half that amount will have been expended at the end of the two years. This is partly due to the generosity of manufacturers, transportation lines, publishers, etc., who have beautified our walls with pictures and added to our equipment at a cost generally much below wholesale prices and often without cost to us. In this way we

have been able to build up a Commercial Museum, which is already a great credit to the institution.

The attendance in Commerce has steadily increased until today this Department enrolls more than twenty per cent of the total registration for the year. The attendance in 1903-1904 was 104; in 1904-1905; 142; in 1905-1906, 128; and present indications are that this year's attendance will reach at least 150. A very encouraging feature of the attendance is the decrease in special students. A large majority enter with the intention of finishing at least the three-year course.

Attendance.

The cost per student for technical work is lower than that of any other department of the institution. The salaries for the years 1903-1907, chargeable to the Commercial Department have not exceeded............$16,000.00

Cost of Department.

Equipment and supplies	1,890.31	
Total .:..........		$17,890.31
Less fees		321.00
Total		$17,569.31

Total attendance for the four years 524
Cost per student a little more than..................$33.00

This includes also the cost of the Department of Political Science. The rate will likely decrease rather than increase, since it appears certain that the attendance will increase more rapidly than the increase in salaries and equipment.

Practically all the changes in rooms, equipment, courses, and instructional force, recommended in my last report have been effected, so that I have very few changes to suggest. If practicable, Mathematics 3 should be given in the second year so as to conform with other courses. I recommend that an advanced student in Stenography be employed at least one hour a day to correct regular typewriting exercises, and that this assistant be employed at once so as to assist in the work this year. I also recommend that a regular assistant be employed next year to take charge of the work in Penmanship, Elementary Accounting, Business Arithmetic and correspondence.

Changes.

I estimate our needs in Equipment and Supplies during next biennium as follows:

Equipment. and Supplies.

1 new Remington typewriter	$ 70
Supplies—Stenography	125
Supplies—Accounting	100
General equipment	100
Total	$395

About $100 additional will be required for books and periodicals.

The success of former students, their loyalty and enthusiasm for the welfare of the Department and for the whole institution; the increase in attendance; the reputation the Department enjoys at sister institutions; and the bright prospects for the future are very encouraging features in our work. By the continued support of the State and the encouragement of the administration, the School of Commerce will continue to work for the welfare of the State in general and especially to promote the interests of the commercial classes.

Respectfully submitted,

J. A. Bexell,

Professor of Commerce.

POLITICAL SCIENCE AND INDUSTRY.

To the President of the College,

Sir:—The Department of Political Science and Industry has progressed more rapidly and, to those immediately concerned therein at least, more satisfactorily during the past two years than in any other biennium of its history.

Historical.

As requested in our last report, room 105 has been given to this department, and has been well equipped with new furniture throughout, including a set of cabinets. A table and chairs have been provided for departmental library and research work, and it is evident that the students appreciate these efforts to assist them in their class work. In the last biennial report from this Department it was stated that letters had been sent to manufacturers throughout the country asking for materials for object lesson work in industry and geography. It is pleasing to report that in response we have received about two-hundred specimens and samples of articles in various stages of manufacture, and that the entire col-

lection cost only $3.00 to the College. These articles are now arranged in glass-faced cabinets, provided by the College, and every care is taken to preserve them in good condition. It is the purpose of the Department to add to this collection and provide an ideal museum along the lines suggested.

As an aid to work of this department a sort of a clipping bureau has been established whereby desirable articles found in newspapers, magazines, etc., are clipped by both teacher and students and placed on file in the department, so classified that they are readily accessible. The nature of our work is such that only by so doing can the rapid progress of the world be understood. The work of the Department consists now of the following prescribed studies: Civil Government, Commercial Law, Comparative Study of Government, History of Commerce, and Production and Manufacture; and, in addition to these ,the following optional subjects: International Law and Constitutional Law.

A course in Physiography has been added to the work of the Department this year, and one class in Geography is also taught.

The increased interest on the part of the students during the last two years has been very gratifying. Classes are larger and with very few exceptions there seems to be a growing determination on the part of the students to do their work thoroughly.

Requirements. The Department respectfully asks for a suitable filing cabinet for clippings and all kinds of auxiliary papers so necessary in this line of work. It will be necessary also to have more cabinet space and some new books for the library. One hundred and fifty dollars would probably answer all purposes.

Respectfully submitted,
E. W. Robinson,
Professor of Political Science and Industry.

ENGINEERING AND MECHANIC ARTS.

To the President of the College,

Sir:—Since my last biennial report to you on the condition of and requirements for the School of Engineering and Mechanic Arts, two events have occurred which have very se-

riously interfered with the work of the School. I refer to an act of the last session of the State Legislature, amending Section 2087 of the Revised Statutes of Utah for 1898, so as to prohibit the Agricultural College of Utah from offering courses in Engineering, and to the fire which occurred on September 11, 1905, by which the entire Mechanic Arts building and its equipment, with the exception of a single room 30 by 50 feet, containing the apparatus for testing the elasticity and resistance of materials of construction, were destroyed.

Historical.

At a meeting of the Board of Trustees held July 8th, 1905, it was ruled that "the College is under obligations to allow students who have already entered the institution for engineering to continue their courses and to be graduated upon completion of the work required at the time of entrance."

Immediately after the fire referred to, the State Board of Examiners authorized the Board of Trustees to incur a deficit for the purpose of restoring the building and apparatus destroyed.

In consequence of the law prohibiting the College from offering courses in Engineering, and notwithstanding the decision to allow students already enrolled to continue their work in engineering, a large number of our students in these courses failed to return to the College, and a very few others changed their courses. Moreover, the College did not feel justified in adding new equipment for engineering instruction, nor was it deemed consistent to fill the vacancy in the chair of Civil Engineering. Thus, while the work in Engineering has continued, the classes have become smaller and smaller. The work has not been as successful as that which had characterized the work in this Department formerly on account of lack of additional equipment and inadequacy in teaching force. Besides, the feeling of uncertainty among both students and instructors has made the work more irksome, and the consequent lack of enthusiastic interest has been more or less noticeable.

MECHANIC ARTS.

On account of the fire's coming immediately before the opening of school, all the work in Mechanic Arts was necessarily postponed and many students remained away from school on that account. Through the active interest of everyone concerned, the work of reconstruction was pushed as rap-

idly as circumstances would permit. Many delays, however, occurred on account of inability to obtain building material or to get it delivered; and also on account of the inclemency of the weather. The first part of the new shop was made available for regular work not earlier than February 1, 1906, on which date the regular work in forging began. In the meantime, however, the Drill Hall in the Main Building had been fitted up with new benches built by the Carpentry Department, and work began in bench work on December 12, 1905. The machine shops were finished later. It was necessary that the concrete floor should be well set before the work of erection of machinery could begin, hence the regular class work in this department was delayed till April, and indeed very little of this work was done last year. Most of the students registered for machine work were advised to change their registration for the year to forging. While, on account of the conditions above stated, there was considerable falling off last year in the attendance in the Mechanic Arts classes, the indications at present are that the Department has lost none of its popularity, and that it will have a larger attendance this year than ever before.

The construction of the new plant and the purchase of new machinery offered opportunity for improvements in many respects; consequently the College is now favored with a more efficient plant for the work in Mechanic Arts than the old plant afforded, although that was considered among the very best in the country. A comparatively small expenditure of money for equipment will make the present plant very complete and not until the attendance shall have increased so that more room will be required, will any large sums of money be required for equipment for the work in Manual Training in Mechanic Arts. While the fire must be regarded as an unfortunate disaster, the injury to the work was temporary. The restoration has been complete, and the efficiency of the Department is even now better than it was prior to the fire.

The instructors and students have done a very large amount of work in the process of construction of building equipment to replace that destroyed by fire.

Immediately after the fire, by courtesy of Messrs. Anderson and Sons, the College was given the use of their shop and machinery, and a force of carpenters—instructors and advanced students—began the construction of new work

Work of Instructors and Students.

benches, etc. Two forges were temporarily set up at the shop and a force of blacksmiths—instructors and advanced students—prepared all the wrought iron parts used in the reconstruction of the building, and in the erection of new machinery, and also did the work of installation of new apparatus in the forge, foundry, and carriage shops, including exhaust and blast systems for the same. As soon as the ceilings were completed in the machine shop, another force of students, under the direction of the foreman of the machine shop, undertook the work of putting up line and counter shafts and finally the setting of all machinery in both shops.

Since the regular class work began, nearly all the work of the advanced students in Mechanic Arts has been devoted to the construction of new equipment such as work benches, supply and tool cabinets, class and office furniture, repairs of damaged apparatus, etc. Thus, while our showing during last year and this year up to date in saleable articles has been smaller than in some years past, the amount of work done of an advanced nature and its value to the College has been far greater than that of any similar period in the past. Much credit is due to the foremen and instructors of the various departments as well as the more advanced students for the excellent results above indicated, which appear more fully in the partial list of details subjoined.

Partial list of details of work done by the Department of Mechanic Arts in the construction of the new shops and plant:

FOR THE YEAR 1905-1906.

16 double carpenter's work benches.
1 single carpenter's work bench.
1 large supply case in main bench room.
1 small supply case in main bench room.
2 foreman's desks and file cases.
24 saw horses.
1 adjustable drawing table.
1 10-foot book stack in office.
1 letter file and stationery cabinet in office.
2 key lockers.
1 supply case for oils and varnishes, etc.
1 supply case for Machine Shop.
1 24-drawer tool tray case for Machine Shop.

2 supply cases for Forge Shop.
1 102-locker tool and exercise case in Forge Shop.
156 running feet vice benches for Forge Shop.
210 beam and wall hangers for building.
96 beam hangers for shaft hanger blocks.
17 truss rod saddles.
34 truss rods.
34 truss straps.
850 bolts for trusses, beams, etc., for building.
250 anchor bolts and plates for building.
150 anchor bolts and plates for building.
62 long shaft hanger bolts.
96 draw bolts for carpenter benches.
All draft pins used in construction of shop.

Built sixteen forges out of eight parts from 32 forges which went through the fire.

Installed the complete plant for the forge, foundry, and carriage shops, including blast and exhaust systems, connecting up 32 forges with blast and exhaust system, setting and anchoring 32 anvils and anvil blocks, setting up and connecting three fans and motors, one power hammer with repairs, emery wheel, blacksmith's drill and line and counter shafting for all driving purposes in this Department.

Installed the complete equipment of the Machine Shops in wood and iron, including 45 machines, two motors, 185 feet main shaft, 32 counter shafts, and 85 belts.

Built stock racks in Machine Shop and forge shops.

Wired entire building for light and power.

Made a multitude of small things, ladders, repairs, etc., too numerous to mention.

Furniture was made as follows in the regular class work:
2 Mission chairs for Director's office.
1 Table for class room.
1 Oak china cabinet.*
1 Oak cellarette.*
1 Oak settee.*
1 Umbrella stand.*
1 Single seated mountain buckboard.*

This report does not include exercise work of elementary students, but only such as become part of the regular equip-

*Salable.

ment of the College or such as has a considerable monetary value.

Work done during present school year up to December 12th:

EQUIPMENT.

1 20-Locker cabinet for turning tool trays.
28 Lockers in wash room.
58 Running feet vise benches in Machine Shop.
4 Double carpenter's work benches.
3 Single carpenter's work benches.
1 tool case in wood Machine Shop.
1 Drawer cabinet for shop drawings and materials.
1 Stand for oil tanks in Machine Shop.
1 Moulders' work bench for 12 students in foundry.
1 Tool rack in forge shop.
1 Feeding platform and stairway for iron melting cupola.
1 Supply closet under stairway in main bench room.
4 Mechanical drawing desks.
6 24x30-inch drawing boards.
1 Foundry supply case.
1 Flask loft.
1 Wheel Jack and tire setting frame.
1 Supply case for bolts, nuts, washers, etc., for carriage shop.
8 Forge benches.
1 Case for models in forge shop.
2 Dozen foundry flasks.
1 Blue printing frame and carriage.
1 Blue printing bath.
1 Dozen blacksmith sledges.
4 Dozen anvil tools, swages, fullers, flatters, etc.

REPAIRING.

32 Full sets of forge tools.
1 Foundry rambler, including erection.
1 Foundry cupola, including 10 feet extension and lining.
1 Emery wheel stand.
1 Drill chuck.
6 Machine vices.
1 16-inch crank shaper.

FURNITURE.

4 Class room tables (pine).
1 Double door book case (poplar).
1 Serving table (poplar).
1 Trophy stand (oak) in Library.

Besides the work above indicated considerable progress has been made in the restoring of our very comprehensive set of shop drawings.

The above lists indicate the class of work done, and also indicate the policy of the Department in the matter of self help. While part of the work for the construction of equipment is represented on the pay rolls of the College, by far the greater part has been done without cost to the College for labor, having been done as regular class work by students, or by instructors, during vacation time, on Mondays and such other time as they may be spared from regular instruction work.

System of Reporting Work.

During the present school year, a system of reports of work done with time spent has been inaugurated by which the time of every individual (elementary students excepted) is accounted for, the actual cost of each article finished is shown and incidentally the relative efficiency of students working on identical articles is made very apparent. The operation of this system of reports indicates already a very pleasing improvement of the work in general. The knowledge that a record of every hour's work is filed and the cost data resulting seems to have made the students generally more ambitious to make a good record. We believe that it has a high educational value aside from the habit of industry which it promotes in that it brings the students into direct contact with modern mill-work system, thereby not only preparing them for a place in such systems when they shall have finished their work here, but enabling them in many cases to reform the old "hit or miss" systems where profit and loss are counted on gross results only instead of the more accurate and up-to-date method of determining exactly profit or loss on each individual operation.

ENGINEERING.

As matters now stand the engineering work of the College is doomed to complete obliteration. Should the law above referred to be allowed to remain upon the statute books, a permanent and irreparable injury will have been done the Agricultural College of Utah, and it will ultimately have to descend from the high position which it has assumed among the agricultural colleges of the land. The work in engineering is so closely and intimately associated with the agricultural work of instruction and research that its elimination renders the curriculum of the College incomplete and its remaining work one-sided and more or less inefficient.

The separation of the work in engineering and agriculture is directly contrary to the spirit and letter of Congressional and Legislative Acts establishing the College. "Agriculture and Mechanic Arts" is the phrase used, and the intention and meaning of the phrase is clearly manifest by the way in which it has been applied in the arrangement of the curriculum of the various "Land-Grant Colleges" throughout the country. The language of the Congressional Act is:

The Federal Law.

"The leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the *mechanic arts* in such manner as the legislatures of the states may respectively prescribe in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

Senator Morrill, the father of the Agricultural College idea, says, "The act of 1862 proposes a broad education by *Colleges* not limited to a superficial and dwarfed training, such as might be had in an industrial school. . . . . . If any would have only a school with equal scraps of labor and of instruction, or something other than a *College,* they would not obey the national laws."

The spirit in which this interpretation has been accepted by the various states is indicated by the almost *universal* association of Engineering and Agriculture in the Land-grant institutions of the various states. In order that there may be no misunderstanding on this point we quote an official inter-

pretation from the Department of the Interior of the term "Mechanic Arts," by which it is made to include all engineering science.

The Department of the Interior, on Dec. 7, 1900, announced officially a classification of subjects included in the provisions of the Act of 1862, above referred to, and the supplementary Act of 1890. According to this classification we have under the heading, "Instruction in *Mechanic Arts*" the following:

"1—Mechanical Engineering, 2—Civil Engineering, 3—Electrical Engineering, 4—Irrigation Engineering, 5—Mining Engineering, 6—Marine Engineering, 7—Railway Engineering, 8—Experimental Engineering, 9—Textile Engineering, 10—Architecture, 11—Machine Design, 12—Mechanical Drawing, 13—Ceramics, 14—Stenography, 15—Typewriting, 16—Telegraphy, 17—Printing, 18—Shop Work."

This College has given instruction in three out of the eighteen subjects enumerated above as belonging to its legitimate sphere. And for this the College has been and is being severely criticized as having abandoned its legitimate field and entered upon foreign premises to the extent of offering instruction in engineering.

The Territorial Legislature accepted the conditions of the Federal Acts without restriction in any particular. The State Constitution recognizes the College without any restrictions of its work as outlined, and the State Legislature in 1896 further recognized directly the scope of the term "Mechanic Arts" by providing for the maintenance of a course in "Manual Training in Mechanic Arts."

Relation of Engineering and Agriculture.

The interpretation is logical and consistent. In this region Agriculture is possible only on account of Irrigation; and this is not a remote or far-fetched relation but a relation which is so intimate as to make these operations inseparable. Irrigation is nothing more or less than civil engineering with special emphasis on hydraulics. Again, Farm Mechanics is unquestionably an appropriate and necessary part of an Agricultural College curriculum. It certainly could not be maintained that anything like adequate courses in Agriculture should not afford its students an opportunity for at least a fundamental knowledge of the laws, principles and practices in the

design and operation of the machinery which goes to make up the farm equipment. Such a course is nothing more or less than a course in Mechanical Engineering. It thus appears that the proposition to eliminate the Engineering courses from the curriculum of the Agricultural College and expect to build up and maintain strong courses in Agriculture is a flat contradiction of terms.

Again, it seems sheer folly to require any institution to give courses in the purely Manual side of Mechanics, and then to prescribe that anything pertaining to the mechanical properties of materials or the laws and principles of construction, or to the laws and principles underlying the design and operation of machines, shall not be taught.

Thus, from every point of view our present predicament is unnatural and contradictory. It was intended by the fathers of the idea of an Agricultural College that Agriculture and Engineering science should be co-ordinate and component parts of its curriculum. It was so intended by the founders of our own College as is manifest by the fact that the Engineering courses were included with the courses in Agriculture in the very first announcement of its curriculum and have continued to appear as such without protest until within the last few years, when certain persons who seem not to appreciate the problem of industrial education in our State began the agitation which resulted in the ill-advised law above referred to. The nature of things in this region especially requires that in order to offer adequate tuition in Agricultural Science both Civil and Mechanical Engineering should be included. To require training in the Manual Arts but not allow study of the Science upon which these Manual Arts are based is an arbitrary and contradictory restriction. From every point of view the proposition is illogical, unnatural, inconsistent and uneducational.

LAW DUE TO MISUNDERSTANDING.

In my opinion the statute in question is founded on misunderstanding, or it may be misinformation.

First, the custom of referring to our course in "Manual Training in Mechanic Arts" as simply "Mechanic Arts" without the restricting adjectives, may produce, and undoubtedly has produced in the minds of many the impression that the term "Mechanic Arts," as used in the Acts above quoted relating to

the establishment of Colleges of Agriculture and Mechanic Arts, is entirely comprehended by our *Manual Training Course* in Mechanic Arts;

Second, a notion seems to be more or less prevalent that a course in Agriculture is limited to certain studies relating directly to the growing of crops or care of the herd, instead of that "broad and liberal education" which is defined and described in the acts establishing the Agricultural Colleges.

Third, (and here I apprehend is where misinformation has played its most conspicuous part) an idea has been very widely spread to the effect that the cost to the State in providing facilities for engineering instruction in this college has been something extraordinary, and entirely out of proportion to results, and further, that enormous sums of money are about to be demanded for the maintenance of such educational facilities. Statements of this character have been spread broadcast among the citizens of the State. Various estimates of the financial saving to the State by eliminating the Engineering courses have been made, most of which are absurd and without foundation of facts.

Expense.

The following facts compiled from the official reports and inventories of the Secretary of the Board of Trustees, show what the expenditures have been up to date.

The first expenditure for Engineering appears in the Secretary's report for biennium ending Dec. 31, 1893, and is as follows:

For Civil Engineering $395.27

Engineering up to 1899 is shown by inventory of College property which appears in the Secretary's report of that year as follows:

For Civil Engineering	$613	
For Mechanical Engineering	315	
Total expenses for Equipment up to 1899..		$928

The Secretary's inventory of date Dec. 31, 1904, shows a total cost of equipment for Engineering as follows:

Equipment for Testing Laboratory....	$3,907.00	
Equipment for field work in Civil Engineering, not including office furniture	1,283.95	
Total		$5,190.95

This total shows an average for the fourteen years 1890-1904, inclusive, of a little less than $371 per year. Nor does a reference to the salary roll show a very extravagant expenditude of money in this respect. The Engineering faculty has consisted of two men, both of whom have had other duties besides instructing in Engineering. Ever since the establishment of this College the Professor of Mechanical Engineering has been Director of the Shops, part of the time doing part of the regular class work in the Machine Shop. Up to 1901, the Professor of Civil Engineering did the work of Irrigation Engineer for the Experiment Station. So that the salary roll chargeable to instruction in Engineering amounts to no more than $2,400 per year.

Certainly the argument that a very considerable saving of money to the State will be consummated by the elimination of this work from the College falls to the ground absolutely if the record of expenditures up to date may be accepted as a basis. The last Legislature was asked to appropriate a lump sum for an Hydraulic Laboratory for experimental work in irrigation and hydraulic engineering, and also, because of a peculiar natural advantage, to appropriate a sum of money for the improvement of the water system greatly needed for fire protection, and still further for an appropriation for an electric light and power plant for College service in connection with the hydraulic laboratory. These three sums were added by advocates of the law above cited and charged to engineering equipment, and this total figure became the sole basis for the absurd estimates made regarding our expenditures for engineering instruction and the saving to the State by its elimination. Of course the only logical conclusion for such argument is that, if the Legislature had seen fit to make the appropriations asked for, the College would ask for a new hydraulic laboratory, a new water system, and a new electric power plant annually.

On account of the foregoing reasons I most urgently recommend that every available means be used to induce the next

Recommendations.

session of the State Legislature to repeal the law eliminating Engineering Instruction from the curriculum of this College and that *regular* work in Engineering be resumed.

The requirements for adequate instruction in Engineering were fully set forth in my last biennial report, and I respectfully refer you to the argument therein.

FINANCIAL REQUIREMENTS.

For further Equipment of Shops for Mechanic Arts I recommend that additional equipment as per subjoined list be provided for.

Iron Machine Shops.	2 additional engine lathes...$	800	
	Counter shafts, belts, pulleys and extras for machinery subjected to last year's fire to be restored by the Department	700	
	Total for Iron Machine Shops		$ 1,500
Forge Shops.	1 heating furnace..........$	200	
	1 tempering furnace	200	
	1 annealing box	150	
	Total for Forge Shops..		550
Carpenter Shops.	1 tenoning machine ....$	400	
	1 wood trimmer	150	
	7 wood turning lathes	500	
	Total for Carpenter Shops		1,050
Supplies.	The increased attendance of students for shop work will require some additional supplies. For lumber, blacksmith's coal, foundry coke, iron and		

	steel, including pig iron for the foundry, paint, nails, screws, files, sandpaper, emery cloth, glue and other general supplies, for carriage building, upholstering, etc., we shall require at least	$ 7,000	
	Estimated income from sales of products of Mechanic Arts Department	1,000	
			$ 6,000
Engineering.	Hydraulic laboratory, including experimental pipe line from Logan, Hyde Park and Smithfield canal.....	$20,000	
	Hydraulic meters	800	
	Books and magazines	500	
	Additional field instruments.	450	
	2 additional current meters..	150	
	Total for Engineering..		21,900
			$31,000

In the event that the law referred to shall remain in force, I recommend that the action of the Board of Trustees to the effect that Engineering will be taught to students already enrolled at the time of the passage of the law remain in force for the period of one more school year only, i. e., till the present Juniors shall have been given an opportunity to graduate and that thereafter Engineering Instruction be suspended entirely.

As was pointed out in my last report the chief need of the Engineering Department is a first class Hydraulic Laboratory for which the College possesses unexcelled natural facilities, but it must not be construed that the amount asked for for equipment at this time represents an average of what will be required during succeeding bienniums. As is shown elsewhere in this report, the expenditures for equipment for Engineering up to the present time have been very small indeed. In order, however,

Conclusion.

that suitable facilities for experimental work in Hydraulics may be had, it is necessary that the amount asked for should come in one lump. The *average* annual expenditures for Engineering equipment since the time the College was established up to the end of this biennium, should the appropriation above asked for be allowed, will more nearly represent the average expense in the future.

Respectfully submitted,

Jos. Jenson,

Director School of Engineering and Mechanic Arts.

CHEMISTRY.

To the President of the College,

Sir:—I submit herewith a report for the Department of Chemistry, including a review for the past biennial period followed by a discussion of the needs for the next biennial period.

Historical.

The courses of study in chemistry have remained practically the same, except that Toxicology, which was formerly designated Chemistry 11, has been temporarily discontinued, and a brief introductory course in general chemistry designated as Chemistry A, has been added. Two considerations influenced us to drop the course in Toxicology. First, a re-distribution of college and station duties among the members of the Chemical Department staff left us without time to give this course proper attention; secondly, we urge the students to give more time to the fundamental exercises in qualitative and quantitative analysis. Chemistry A was added in response to a demand from those in charge of the engineering courses and the short agricultural course for a course in general chemistry which should not require the time and work necessary for the more thorough course, Chemistry I, but which should give the student some familiarity with the more elementary principles of the subject and a few of the more common elements and compounds.

All courses offered in the present catalogue except the Research Work (Chemistry 13) have been given during part or all of the last two years. As was anticipated, Organic Chemistry and Agricultural Chemistry had to be given each year. Chemistry 8, Advanced Theoretical Chemistry, was omitted two years but now is being given again.

The instructing force at present consists of the Professor of Chemistry on one-fifth time; the Assistant Professor of Chemistry on four-fifths time; and the Instructor in Chemistry on full time.

In the line of equipment and stock of supplies, the Department has made gratifying advances. Nine out of the eleven work tables in the general chemical laboratory have been so changed by providing partitions and suitable locking device that each table can accommodate twice as many students with locker room as formerly. This provides table room for eighty students working in two or more sections, provided no section is larger than forty-four. A ventilation system for the hoods is being installed which when complete, besides giving forced draught to the hoods, will also afford some ventilation for the rooms. An automatic blowing device for the gasoline gas generator is being installed to do away with the troublesome winding up of the gas machine by hand. More case room for books and for photographic negatives and chemical specimens has been or is being provided. Other minor improvements in the furnishings of the rooms have been made which places us for the most part in good position to accommodate the present number of students. In the line of apparatus, some long felt wants have been supplied. The stock of supplies, both the apparatus and the chemicals which are subject to steady consumption, is well replenished. In library books and periodicals some additions have been made.

It is not proposed to make any extensive changes in the courses offered. The sections in General Chemistry (Chemistry I) are as large as is conducive to good results. Any material increase in the number of students in this course would make it necessary to organize a third section. This, it will be noticed, is the course in chemistry which is required of practically all college students, in whatever course or school they may be registered. The advanced courses in chemistry are nearly all distinctive of some special course of study or school of the College. Therefore the number enrolled will always be limited by the number of students at that stage of advancement in the particular general course or school. Thus Agricultural Chemistry (Chemistry 3) is especially for sophomores in Agriculture. Chemistry of Foods and Cookery (Chemistry 4) is especially for the seniors in Domestic Science. It is not probable that the natural increase in students pursuing these or others of the

Requirements.

special courses will necessitate any division into sections soon. I would, therefore, estimate that the present teaching force with some increased allowance of time or assistance to correspond to the increase in General Chemistry students, will suffice for another biennial period.

In the way of general equipment we are in better shape for work now than we have ever been before in the history of the Institution. The needs for the next biennial period are relatively small.

Among the articles yet needed may be mentioned a storage battery with a dynamo to charge it, a good stereopticon with slides, a set of organic chemical specimens, three more tables for general chemistry, and a small steam plant to heat drying ovens and water baths, and to prepare incidentally distilled water. We hope that part of these can be secured from the funds now available. If the steam plant above mentioned could be installed, it would save the Institution a few hundred dollars each year now spent for gasoline. As the price of gasoline is very high, and apparently still rising, it becomes all the more necessary to substitute cheaper fuel where possible.

Additional storage room is needed for such College and Station samples and old apparatus as are to be preserved, but which we need to reach only on rare occasions. I suggest that a floor and partitions be constructed in a garret room in the north wing of the building. If at any time in the rearrangement of rooms, or the fitting out of new rooms, it becomes feasible to provide one of suitable size and suitably lighted to use in photographing groups, such should be provided.

For supplies we need the usual amount to replace that consumed or lost through breakage, and to keep up the stock about as it is now.

Below are summarized the estimated needs of the Department, exclusive of salaries of instructors, for the next biennial period:

	Dynamo, storage batteries and accessories	$ 100	
	Stereopticon and slides for chemical subjects	150	
Equipment.	Organic chemical specimens	200	
	Three additional tables for general chemistry	450	
	Steam plant for drying ovens and water baths	250	
	Finishing room for storage	125	
	Miscellaneous apparatus and furniture	300	
	Total for equipment		$1,575
	Chemicals for two years	$ 600	
	Chemical apparatus of the breakable class, which is supplied to the individual students	500	
Supplies.	General repairs for two years	150	
	Total for chemical supplies (in the main part covered by fees and breakage bills charged to students)		$1,250

If as in the past few years the photographic supplies and the gasoline are to be charged to the Chemical Department,then in addition to the above, about $150 should be provided for the former, and $500 for the latter.

Total inter-department supplies	$550
For library books pertaining to chemistry	200
For extra help, including storeroom keeper and stenographic help	550

Respectfully submitted,
P. A. YODER,
Professor of Chemistry.

ZOOLOGY AND ENTOMOLOGY.

To the President of the College,

SIR:—The work this year is the same as that outlined last year by my predecessor with the exception that the course in Bacteriology is now given in the Department of Veterinary Science instead of in this Department, as formerly.

I recommend no changes in the courses of work. They are sufficient to cover all the needs of the Department at present. It does seem advisable, however, to arrange the work differently. At present too much time is occupied in most of the courses, with not enough concentration. Our whole course of study would be strengthened, it appears to me, if most of the two and three hour courses were made more of a unit by doubling the amount of time spent on them and making them

Courses.

one term subjects. This is especially applicable to the work in Zoology where a certain amount of laboratory equipment must be furnished each student. According to the present arrangement, he cannot be given the equipment exclusively on account of the length of time between laboratory periods and consequently cannot be held as readily responsible for damage done. If the necessary work came oftener, a student could be supplied the necessary apparatus and held entirely responsible for it. Such an arrangement, of course, would necessitate the installing of a number of lockers in the laboratory. The cost of these, however, would be small. Laboratory supplies, also, under such an arrangement would not have to be held in stock so long. Besides being advantageous in the distribution of supplies and equipment, this arrangement would encourage better work on the part of the student, by supplying him with definite equipment, for which he is held responsible; and by increasing the amount of work per week.

The rooms at present used by this Department are the following: Room 36 (class); room 33 (this room was divided by a partition in 1905 into a laboratory at the north end and a combination office and laboratory at the south end); room 34 (museum); and in addition to these a store room in com-

Room.

munication with the museum. This room at present serves the double purpose of store room for the museum material, both unprepared specimens and wares, and library store room. Room 34, also serves for a practice room for the band. This arrangement

will be satisfactory for some time, perhaps a year or two, but eventually the whole of room 34 will be needed for exhibition purposes. The arrangement of rooms is at present satisfactory. The museum is near the class room and the laboratory,and consequently convenient for demonstration purposes. This arrangement is especially necessary on account of the fact that material for class work and laboratory work is usually exhibited in the museum when not otherwise used.

Needs.

The class room (34) should be equipped with a demonstration table. This is vitally necessary in a zoological lecture room on account of the fact that instruction is largely by demonstration from models, skeletons, bones, charts, dissections, and preserved material; and surface for display, as well as a few handy drawers for storing needed material, is needed. Such a table with water connection could be installed for $100.

For class work in zoology and entomology, a set of at least thirty Leuckart charts should be purchased. They would cost $50. Our collection of skeletons should be increased by a number of new specimens or parts of specimens, which could be purchased for $100.

In an agricultural college the work in such subjects as veterinary medicine and stock breeding, finds a prominent place, and from the present rate of progress of agricultural work in our institution, it seems safe to predict that such work will ultimately demand special degrees. In such a case, the Department of Zoology and Entomology would be expected to give regular prescribed courses in at least Embryology, Vertebrate Zoology, and Histology. Such being the case, it seems wise to begin, at least, to build up these courses as regards equipment. Even our present and immediately future work in Embryology demands the purchase of a number of models in wax and a set of microscopic slides. These could both be purchased for $150. The laboratory should be equipped also with a few more high-class microscopes and a number of dissecting miscroscopes which could be purchased for $225.

For work in Histology, provision should be made by purchasing one new microtome and a new lot of chemicals. An appropriation of $200 should be made for these purposes.

It is imperative at this time to begin the formation of a department library where can be found the standard works on biological science. A fund should also be provided to enable the Department to subscribe for certain scientific periodi-

cals, which cannot be properly expected at the general library. I hesitate to estimate the cost on account of the fact that the library could be started at a cost varying from a hundred or less to a thousand dollars. Some arrangement, however, should be made for this request.

A dictionary and a stand should be placed at the disposal of the Department. This would cost about $15.

A small case for chemicals and other laboratory materiials should be provided. This would cost $30.

The Department needs badly a desk telephone to avoid numberless trips to and from the Station, and other parts of the College grounds. Fifty dollars would be sufficient for this.

An aquarium is one of the most pressing necessities of the Department. It would greatly facilitate the preserving of material and would also be of value in a general educational way. It could be installed for about $40.

A sink should be placed in the northwest corner of the laboratory. Such a fixture is a constant necessity in dissecting work and students should not be forced to break into their work, and the work of others, by walking into the next room. As the work advances, dissection will be more and more introduced and the need for a handy sink will become imperative. A suitable sink could be installed for $30.

For advanced work in entomology, the Department needs some equipment along the line of breeding cages, slides (lantern and microscope), models, and dissections. These could be purchased for $150.

A zoological laboratory and lecture room is greatly handicapped unless provided with a convenient projection lantern. Such a lantern would be of value to the whole institution. It could be used, to immense advantage, in addition to its direct utility in zoological lecture work, in winter school work, nature study work, and numberless other ways. A suitable lantern and accessory equipment would cost $125.

For museum cases, $150 will be needed for the next two years, and for glass ware, $50.

A few typical sections should be purchased for work in zoology. Thirty dollars would suffice for this item.

Two hundred dollars should be appropriated for museum purchases and part of this could be used also, if necessary, in the purchase of material such as slides, models, etc., as needed.

For supplies in zoology and entomology for the next two years about $317 will be needed.

Summary of Needs.			
	Demonstration table with water connection .....$	100.00	
	Leuckart wall charts of dissections and life histories	50 00	
	Skeletons of Foetus and Dolphin	20.50	
	Skeletons of cat, pigeon, and dog fish	33.00	
	Gorilla skull and gorilla's bust	30.00	
	Hyoid bone (Human) ..	2.25	
	Modifications of fore and hind limbs in gar, pike, snapping turtle, armadillo, hog	17.00	
	Embryo models in wax and embryo slides	150.00	
	Compound and dissecting miscroscopes	225.00	
	Microtome	83.00	
	Chemical case	30.00	
	Dictionary and stand ...	15.00	
	Aquarium and sink	70.00	
	Breeding cages	20.00	
	Lantern and microscope slides	90.00	
	Mounts	10.00	
	Projection lantern	125.00	
	Miscellaneous	30.00	
	Museum cases and glassware	200.00	
	Specimens and mounting.	200.00	
	Total equipment ...		$1,183.75
Supplies.	Supplies for zoology and entomology		317.00
	Grand total supplies and equipment		$1,500.75

Respectfully submitted,
E. G. PETERSON,
Assistant Professor of Zoology and Entomology.

GEOLOGY AND MINERALOGY.

To the President of the College,

SIR:—During the school year of 1905-06 three courses were given in geology and mineralogy, and a two-hour course was given in Chemistry 11, requiring nine hours of instruction in the Department. This year courses are being given in Geology 1, 2, 3, and 5, and a course in Chemistry 11. The remaining courses require nine hours of my time for instruction.

The lecture room formerly occupied by the Department was given up last year to the Department of Mathematics, and now the lectures are given either in the mineralogical laboratory or the physics lecture room.

During the last year the Department has purchased one set of physical maps, one Jolly's specific gravity balance, a few much needed mineral specimens and the necessary supplies with which to carry on the laboratory work.

The museum is greatly in need of floor cases and glass doors for the wall cases now in use. Much of the material which we have is poorly classified for the want of better arrangements. The specimens we have for mineralogy are very limited and should be increased both as to number and variety.

It is not the plan to materially change the courses for the next two years, but to strengthen the courses already given by demanding more field work as a part of the course. To do more efficient work the Department should be furnished with the following:

Needs.

Paleontological specimens.....	$ 150	
Relief models	200	
Museum cases and repairs.....	250	
Mineral specimens	100	
Microscope	75	
Expenses in collecting material.	100	
Supplies	300	
Equipment for mineralogy	200	
Reference books for library ...	50	
Total		$1,425

Respectfully submitted,

WILLIAM PETERSON,

Professor of Geology and Physics.

PHYSICS.

To the President of the College,

SIR:—During the school year of 1905-1906 two courses were given in Physics, one in general physics and one in advanced physics. The students taking general physics were divided into two sections for class work, and on account of limited amount of laboratory apparatus took their laboratory work in three sections. This arrangement required ten hours of instruction in Physics.

Historical.

By action of the College Council last June, the beginning course in Physics for the engineering and mechanic arts students was changed from a three hour to a five hour course. This course is now being given in addition to the ones previously mentioned. By this arrangement the Department of Physics is requiring fourteen hours of instruction this year. This same number of hours will probably be required for the next two years.

The Department is well located as regards both arrangement and room. The lecture room was furnished with new settees last year, and is large enough for all class work. The laboratory was provided with two new tables and side desks, but still we are crowded in the work in elementary physics. For the work in both elementary and advanced physics, much additional equipment is needed, and at least two special desks should be provided.

The needs for the Department for the next two years are estimated as follows:

Needs.

Laboratory desks and fixtures..$	250
Instrument cases	75
One dozen Martin's measuring sets	100
Eight sets of equipment for heat tests	400
Eight sets of equipment for work in mechanics	600
Miscellaneous equipment to complete sets on hand...........	720
One solar stereopticon complete	100

One work bench with tools	50
Repairs on instruments	30
Supplies	300
Books for Library	100
Total	$2,725

Respectfully submitted,
WILLIAM PETERSON,
Professor of Geology and Physics.

MATHEMATICS AND ASTRONOMY.

To the President of the College,

SIR:—The courses in this department have not changed materially since our last report, except that the eliminating of the Sub-Preparatory year has decreased the number of sections in Mathematics 1, and greatly decreased the number of students in preparatory work.

Historical.

More sections are required in Mathematics 3 and 4 than heretofore, owing to the large increase in the number of students in the regular college work.

There are four instructors in the Department, two of whom give their entire time to the Department. We urge the employment of an instructor who will give his entire time to the Department.

There are now six regular courses given by the Department and at least one elective will be called for each year.

We will require the entire time of four instructors during the biennium. Men should be selected to fill these places who have completed a college course, and whose interests are primarily along the line of mathematics.

Requirements.

We will require one hundred dollars to furnish the seminar room for the comfort of the advanced students of the department.

Money has been appropriated for the models asked for in our last report, but $200 should be given us to supplement the models required at present and to purchase additional books for our present excellent Library.

We should like very much to have a transit, to be permanently mounted and properly housed, for the work in Astronomy. We have estimates on the probable cost of such an instrument and should be glad to submit them for consideration.

The present enrollment by courses, October 15, 1906, is as follows:

Mathematics 1	38
Mathematics 2	177
Mathematics 3	85
Mathematics 4	45
Mathematics 5	11
Mathematics 6	6

It will be seen from the above report that there are only 38 students in Mathematics 1. There were 151 last year. The eleminating of the Sub-Preparatory year is the cause of the decrease in this course.

Respectfully submitted,

W. S. Langton,

Professor of Mathematics and Astronomy.

ENGLISH LANGUAGE AND LITERATURE.

To the President of the College,

Sir:—Much of what was said in the last biennial report might well be repeated in this, for, during the biennium soon to close, there have been no changes in the general plan of the work of the English Department except such as the absence, last year, of the head of the Department and of the instructor in elocution necessitated. Because of those absences, the elective work had to be limited to three hours a week instead of five or six, and no work in elocution could be given, except in connection with English 7 and debating; but, with the return this fall of the instructor in elocution, the work in the Department has been resumed. The regular work of the Department has been done with such interest and zeal on the part of the members of its faculty as cannot fail to leave a good impression on the general work of the students.

Historical.

Owing to circumstances over which the Department had

no control and which affected the total enrollment of the College, there was a slight decrease in the whole enrollment of the English Department last year, but the outlook at present is for a much greater number this year, especially in the regular College work. All of the classes are filling up rapidly, except those in the elementary courses, English 1 and 2. The abandonment of the Sub-Preparatory Department and the raising of the standard in the Manual Training courses have reduced these courses from four sections each, two years ago, to two each, at most, this year. Not only has the standard of the Department been raised but that of the various classes has likewise been advanced. A marked improvement in individual capacity has been noted this year.

Notwithstanding the loss occasioned by the absence of the head of the Department during the greater part of this biennium, the class room work today shows no apparent decrease in interest and efficiency, the College magazine has lost none of its former excellence, and the dramatic work, omitted last year on account of the absence of the instructor in elocution, will again receive attention. Steps are already being taken to present another of Shakespeare's comedies. As for debating, the Department gave more attention to that work last year than ever before in the history of the School, with the result that debating has become a vital part not only of the work of the English Department, but, through the interest aroused by the sucess of the inter-collegiate debates last spring, a vital, and, we believe, a permanent part of the work of the College itself.

The equipment of the English Department, as stated in the last biennial report, is, outside of the books in the Library, very limited, nor does it need much other than live, wide-awake, thoroughly prepared instructors and a well equipped library; but these are necessary and the work can never be a sucess without them. The College Library is receiving additions from year to year, which are always gladly welcomed by the Department, and yet, each succeeding year we feel more and more the urgent need of more books.

Requirements.

Especially do we need duplicate copies of all the more important works in English literature. The class in English 6 this year, numbering nearly sixty at present, will not be able to do efficient work because of their

inability to obtain, when needed, the books required to be read. A map of Europe and one of England would be found very valuable in making the work of this class effective. The theme cabinet, obtained last year at a small expense, has been of great service both to students and instructors, but a larger one will probably be necessary before the end of another biennium. We think about $200 would furnish all necessary supplies.

The English courses, as outlined in the catalogues during the past two years, have been so satisfactory in meeting the requirements that only a few minor changes have been made during the past two years and but few, if any, changes will be made in the near future. The requests for elective work this year seem to indicate that more time will have to be provided for that work during the coming biennium.

The raising of the standard of work in some of the courses last spring has resulted in a very great reduction in the number of students in English 1 and 2, with a corresponding increase in the more advanced classes. Basing our calculations on existing conditions and the rapid growth of the Department, we believe an extra section will be needed next year in each of the following classes: English 3, English 4, English 5, English 6. With these additions to the present number of sections, allowing from five to six more hours a week for electives, which the work will demand another year, there will be twenty-three more hours of work for which to make provision. In all there will be at least 126 hours of instruction per week in the English Department. There are now three instructors giving their entire time to the work and two, engaged also in other lines, doing about fourteen hours each per week in the Department. This shows the necessity of employing next year another full time instructor, and the character of the work is such as to demand one of good scholarship and experience.

Respectfully submitted,

M. Elizabeth Wyant,

Assistant Professor of English Language and Literature.

MODERN LANGUAGES AND LATIN.

To the President of the College,

SIR:—I have the honor to submit the following report: The work in the Department of Modern Languages and Latin has been in my charge the past two years. With the increasing number of college students, all of whom are required to take some language work, the Department has shown steady growth. The registration this year is twenty per cent in advance of last year. This year the instruction has called for 31 hours class work. This is too much for one instructor, and either an additional instructor will be needed to help in the Department next year, or else the work of the Department should be lessened by withdrawing the course in Latin. The Latin courses have always been elective.

Historical.

The greatest stress should be, and is laid on modern languages. In order that the language work may have the most practical relation to the technical work, students in agriculture and engineering are urged to study German, the young women of the Domestic Science courses to take French and the students in Commerce to take Spanish. Many works in French and German on agronomy, forestry, horticulture, etc., should be purchased for the Library.

Respectfully submitted,

FRANK R. ARNOLD,
Professor of Modern Languages.

HISTORY AND ECONOMICS.

To the President of the College,

SIR:—During the school year 1905-1906 the Department of History and Economics gave instruction in Greek and Roman History, Mediaeval and Modern History, English History, United States History, Government, and Economics. With the present year, 1906-1907, instruction is given in Greek and Roman History, Mediaeval and Modern History, United States History, Government, and Economics.

The present head of the Department was appointed July,

1905, to succeed Professor John Franklin Engle, who had voluntarily retired to do work at the University of California. This report, therefore, marks the beginning of the second year of the present head. In all subjects given last year, the present year shows a marked increase in enrollment, except English History, not given in 1906-1907. In Economics 1, the enrollment has more than doubled; in Economics 2, not given in 1905-1906, there is a large class.

The Department employs half the time of one instructor and all the time of a professor. Text-book instruction, lectures by the instructors, class recitations, student reports, and prescribed supplementary reading is the method of instruction followed. The effort is made to make the student work independently and also to see that the law of cause and effect operates in history and economics.

The historical library, though small, is growing, and by the careful use of material at hand, the students can do their work reasonably well. The Department needs good maps of France, Italy, Germany, and England at a cost not to exceed $30.

The most pressing need is recent standard works on economics and sociology. The age is alive with many questions pertaining to these subjects. Active men and women must think about them. The correct solution involves the perpetuation of the best in our institutions. It is essential that students be taught to think carefully and logically upon social problems. To do this they should have access to and become familiar with the best thought of our age.

Respectfully submitted,

George Thomas,
Professor of History and Economics.

DRAWING.

To the President of the College,

Sir:—The Art Department has been giving work in drawing, designing, composition, painting, modeling, and illustrating. The aim has been to develop the creative and imitative faculties; to stimulate a greater interest in the Arts, and to balance as nearly as possible the objective and subjective branches of study.

Historical.

The quality of the work has been fair. On account of having an almost entirely new set of students each year and a large proportion of these not having had any instruction in drawing, the general average must remain about the same. The work of the Department was exhibited at the Portland Exposition, and several students exhibited their work in the Utah Art Institute, receiving favorable mention.

Six sections a day were required to accommodate the students, the total amount of work being something over thirty hours a week. The sections are becoming so crowded that an assistant is greatly needed.

The expense for the past two years has been very slight. The equipment was sufficient for the work, and the rooms large enough to accommodate the number of students; but with an increase in attendance more room will be required. The furnishings generally are very good, containing models for drawing, plates on design, and a few large pictorial productions. From time to time forms have been brought up from the museum, birds, mammals, etc., and added to the collection but without any expense to the institution. These forms have helped to increase interest in the work. Drawing boards and easels have been added now and then, and will continue to be required in the future.

Requirements.

The Department is in need of some reproductions of famous pictures to be used in composition work, some plates on design and a few more casts. I hope that a substantial sum may be allowed for library books for the Department. For a purchasing fund, from $300 to $400 ought to be allowed. I desire that a request be made for the Alice Art Collection to be exhibited at the College, and an invitation be extended to the artists of the State to exhibit here. The Library and Reading Room can be used for these exhibitions. A sum of $200 should be appropriated for this purpose. Plans have been drawn for rooms to be used by the Department in the future. The scheme is to use the top or fourth floor just west of the stairway and divide that space into six apartments for class rooms and private studio for instruction and for students who have particular work to do and wish to be more secluded. When these apartments have been properly finished and equipped, we shall have a group of art rooms large and commodious enough to satisfy our requirements for many years to come. The esti-

mated cost of these improvements is $3,000, the appropriation of which I urgently request.

Respectfully submitted,

J. S. Powell,
Instructor in Art.

MUSIC.

To the President of the College,

Sir:—The School of Music is in charge of a director, five instructors and three assistant instructors. There are already 163 students enrolled. The students in the various courses are talented and are making good progress, considering that most of them are engaged in other school work and have only a limited time for practice.

As heretofore, general instruction in music is free to all students of the College; to vocal students in the choral work; to those doing instrumental practice in the band, the orchestra or in club work. All general work is under the immediate supervision of the Director. The choir is practicing and will render, during the year, an opera and an oratorio, in addition to the usual study of hymns, anthems and other works suitable for chapel exercises. During the past two years, I should say that not less than 200 students have availed themselves of the opportunity of study in these various general courses.

Scope of Work.

The orchestra, consisting of twenty players, is studying both accompaniment and overture work and will take part with the choir in at least two entertainments of the larger kind during the year.

Six members from the above organization are also drilled in regular dance playing and are fast acquiring proficiency along this line. During the past two years two operas and one oratorio have been presented by the choir and orchestra with much success.

The Military Band is an organization of thirty-five to forty instruments, and has already made a successful showing, having played in several concerts in Logan, Ogden, and Salt Lake City. It has become a strong feature of the Music Department and is extending the name of the institution in the work of concerted or general instruction before referred to.

The Mandolin and Guitar Club is just organizing for the school year. Facility on these instruments can be acquired rapidly, if placed upon a proper basis. It has already been demonstrated that these organizations afford one of the happiest diversions within the reach of young people.

Private instruction is provided in Theory (Harmony and Composition) and on piano, organ, violin, violoncello, mandolin, guitar, cornet, clarinet, saxaphone, and other band instruments.

Private instruction on band and orchestra instruments is being given in some cases without charge where the pupil shows particular talent.

It is expected that several piano students will, with this year, complete the required four year piano course which will entitle them to a certificate of graduation from that Department. We are now using two pianos, which are rented by the Director and Piano Instructor, in addition to the five owned by the College.

During the next two years we should have $800 for equipment. Two hundred dollars will cover the supplies necessary for this period.

Respectfully submitted,

G. W. Thatcher,

Professor of Music.

MILITARY SCIENCE AND TACTICS.

To the President of the College,

Sir:—I have the honor to submit the following report of the Military Department of the College:

I assumed my duties as military instructor on October 1, 1906.

Histroical.

Preliminary drills by squads were held from date of opening until October 30th, when the cadets were organized into a battalion of three companies with a band. Since then company drills, with a few battalion drills, have been held. I am pleased to report that the progress made is very gratifying. The greatest hinlrance to the work is the condition, so often noted by my predecessor, that the new students so greatly exceed in numbers the old that it is difficult to find enough competent assistant instructors.

A new target range has been secured, target erected, and a beginning made in target practice. The cadets are very enthusiastic in this important part of a soldier's education.

The total registration in the Department since the beginning of the year is 211. Of these thirty-eight have since been dropped for various reasons, leaving 173 now borne on the rolls of the Department. Not enough rifles are on hand to fully equip this number. This will be remedied when the new rifles, soon to be issued to replace the obsolete Springfields, are received. Two hundred of the new model have been asked for.

I submit an estimate of funds needed for the next two years.

Needs.

For target material	$ 25	
Expense, two encampments freight, wagon transportation for tents).	90	
Officers' belts, swords, trumpet, etc.	45	
Purchase of spare parts for repair of rifles	20	
Gun oil and cleaning material	15	
Marksman's badges (12)........	10	
Total		$205

Respectfully submitted,

HOWARD R. PERRY,
Professor of Military Science and Tactics.

PHYSICAL EDUCATION FOR MEN.

To the President of the College,

SIR:—In accordance with your request I make the following report regarding the work of the Department of Physical Education.

Scope of Work.

The Department of Physical Education has at its command two fairly distinct means for attaining the end set for it. First, there is as a basis the formal, voluntary drilling of the body for physical development, for the correction of existing physical defects and for the maintenance of the general health. Second, the informal, involuntary exercise gained through competitive

games, i. e., through athletics. The students engaged in this work during the past year were as follows:

Number of men in foot-ball	45
Number of men in basket-ball	60
Number of men in track work	90
Number of men in gymnasium work	115

Some men are taking part in more than one sort of physical exercise.

Equipment.

I advise the installation, in the room now known as the gymnasium, of the appended list of equipment, the estimated cost of which is $942.

Athletics.

The involuntary exercise gained in athletics, while it fails to insure as symmetrical and studied a development, has many advantages not afforded by formal drills. The will power, taxed all day in the forced attention to book study, finds rest in the natural interest of competitive sport, and a recreation not possible in the "physical study" involved in the formal gymnasium exercises.

Character Building.

The drills are fundamental and essential, but physical play is rapidly gaining in recognized importance. Some one has said, "A man is most himself when at play." If this is so, and experience teaches that it is, there is no greater opportunity to be found for character building than in athletic contests. These contests influence the entire student body. It is asserted that the growing impulse toward unselfish public service now felt throughout our land, is due in a large measure to the ideals of fair play and school spirit fostered by the athletics of our educational institutions.

Basket-ball and indoor track athletics are entirely dependent on the gymnasium. The great sports of the year in most of our institutions, foot-ball and track athletics, require level well sodded field and a good cinder track. Largely through the personal efforts of our students with shovel and rake, the foundation for an excellent quarter mile track has been laid. This work will be completed next spring. The value of this work is about $300. I urge that the campus be levelled and water pipes laid.

BATHROOMS AND LOCKERS.

The facilities for dressing and bathing are entirely too limited. The matter of new lockers is especially urgent. A set of seventy-five new lockers, accommodating one hundred and fifty men could be had for $330.

A grandstand is a great factor in the proper conduct of our athletic contests, and I again urge that one be built at a cost of $1,500.

REFORM IN ATHLETICS.

The educational opportunities of athletic contests are so many and so great that they are receiving the attention of great educators everywhere. A great wave of indignation has swept over the country because of the circumstances of dishonesty and dishonor manifested in inter-collegiate contests. In the beginning this reaction dealt with foot-ball. This, however, was only because this form of college sport allowed close physical contact and hence a more obvious exhibition of the real spirit existing. The reforms suggested and the discussion which followed brought to light the fact that the vital error in foot-ball was present in all inter-collegiate sports. Therefore, although a new rules committee has been appointed and the game of foot-ball will possibly be revised, we find the schools and colleges throughout the country making a determined effort to revise the spirit of inter-collegiate contests.

The unanimous opinion is that the spirit of winning at any cost and the idea that the sole aim of a contest is to beat somebody are the fundamental faults.

One of the direct causes of this fault is that our contests have taken the form of a spectacle rather than a game between young men for sport. In this connection, Mr. Bert Waters says in the Harvard bulletin: "Foot-ball essentially is an academic sport, and one that belongs exclusively to the school age. It is played under the best conditions and to the best advantage to the players when the game stands solely for school rivalry in sport. What has hurt foot-ball more than anything else has been the feature of public exhibition. Nearly, if not quite, all the so-called evils of latter-day foot-ball flow from this exhibition feature."

Commercialism.

A movement is now on foot to eliminate as far as possible this tendency toward a public spectacle by making gate receipts merely nominal and by making admission, outside of

the students and alumni, through invitation only. The increased publicity due to "this exhibition feature," is an added evil. Published photographs and personal write-ups distort a boy's conception of his place in the college community. The unlimited and ill-judged praise or blame heaped upon victors and losers creates an abnormal desire to win some how, anyhow, only to win.

The "to win" policy encouraged by the professional coach, the "exhibition feature," the publicity and consequent advertisement of the institution has resulted each season in a quarrel regarding the eligibility of men, a quarrel quite as offensive and demoralizing as the evils which they bring to light. To quote a professor of Brown University, "No gentleman will enter into a friendly contest with a man and simultaneously accuse him of dishonorable conduct." We are constantly asked why we don't do so and so. Our opponents do it and if it is fair for them, it is fair for us. We should, therefore, forbid all contests with those whom we cannot trust and make such rules as will minimize causes for suspicion.

Eligibility Rules.

The ideal toward which all athletic reforms tend is that only those shall compete who are attending the institution they represent primarily because of the educational advantages offered by the institution and who compete for the sake of the sport.

In order to foster this spirit, to relieve the intensity of the "to-win" idea in inter-collegiate contests and to put athletics within the reach of the entire student body, very many of our schools and colleges are reducing the number of inter-collegiate games and are establishing class, club and departmental series of contests.

The Correct Policy.

This ideal of good sport and exercise for the greatest number has always been the aim of the Department, and of your committee.

This policy carried out in the face of the evils of intercollegiate athletics has steadily improved the spirit of our student body until at least one hundred and seventy-five of our young men last year came under the direct influence of the Department of Physical Education. However, we are not yet entirely free from the "to win" ideal with its consequent evils. Even greater efforts should be made to encourage sport among the students generally by class and departmental contests.

REORGANIZATION OF STUDENT INTERESTS.

It is generally believed that all our students should be interested in the athletic, the debating, the musical, and other efforts of any group of students who represent the college in a public way. We should go to a debate or to theatricals; we should meet and entertain the students of other institutions not as an athletic association or a debating society, but as a student body. This I believe is so true that our present organization is inappropriate and inadequate. The entire student body should be brought together in one organization with its president and other necessary officers, and its executive committee. But committees on the various interests should of course be chosen from those most interested in the respective branches of student activity. A greater unity, a stronger spirit of helpfulness and a more uniform sense of responsibility would, I believe, thus be brought about. This plan is in vogue in many institutions and is rapidly gaining ground throughout the country.

A systematic training in the gymnasium supplemented by a hearty interest in athletic contests should be our aim. To realize this aim we need a proper gymnasium building and a well made campus. However, a start in the right direction should be made by equipping the room at present used for a gymnasium with some of the most essential apparatus and aiding the students in their efforts to provide a proper field for outdoor sports by constructing a grandstand.

Requirements.

Chestweights, traveling parallel, mats and miscellaneous equipment	$ 942	
Lockers	330	
Grandstand	1,500	
Campus levelled	300	
Miscellaneous equipment and maintenance	500	
Total		$3,572

Respectfully submitted,
GEORGE P. CAMPBELL,
Professor of Physical Education.

PHYSICAL EDUCATION FOR WOMEN.

To the President of the College,

SIR:—During the biennium now drawing to a close, the Department of Physical Education for Women has carried out faithfully and with good results the plans proposed in the previous report. There has been a marked increase in the enrollment and a greater interest in physical education generally.

Historical.

Through the lectures which have been given on the Physiology of Exercise, the Necessity of Breathing, Bathing and Athletic Sports, and through the practical results attained the students are coming to realize the importance of systematic physical training.

During the year 1905-1906 the instructor was away on leave of absence. During the present year, 1906-1907, two assistants and a gymnasium pianist have been employed.

The few pieces of equipment which we were able to add have aided very materially in making the work attractive and beneficial.

I respectfully urge that at least $1,000 be appropriated for suitable equipment, as follows:

Needs.

Anthropometric apparatus ....$	150	
Chest weights	600	
Intercostal machine, and neck and leg machines	150	
Lockers	75	
Mats, pipe, stalls, etc.	25	
Total		$1,000

Assistance.

Pianist at $5 per month......$	45	
First Assistant at $10 per month	90	
Second assistant at $10 per mo.	90	
Total		$ 225

Respectfully submitted,

RUTH EVELYN MOENCH,
Instructor in English and Physical Culture.

THE LIBRARY.

To the President of the College,

SIR:—In presenting the report of the library during the past two years, there are a few points worthy of special mention. There is a very noticeable increase in the use of the library. The accessions of books have nearly doubled for the same length of time over other years. The new furniture with which the library has been equipped since the last report, is both substantial and appropriate. The tables are particularly good, being inexpensive and durable, and the chairs are strong and comfortable. The various pieces for the magazines are exactly what is needed for their display and convenient use. The covers or binders for the current magazines will preserve them in good condition for binding and give the tables a much more orderly appearance. The map cabinet was designed particularly for the valuable set of topographic and geological maps which are being issued by the U. S. Geological Survey. It is an elegant and most useful piece of furniture. The three new steel stacks which were thought to be sufficiently commodious to hold the accessions for two and perhaps four years to come, are now completely filled. The following is a list of the new furniture:

Historical.

12 large tables.
1 magazine table.
4 round tables.
110 chairs.
1 magazine filing table.
2 magazine racks.
1 newspaper rack.
1 map cabinet.
3 steel stacks.

The following is a summary of Library accessions during the period beginning November 5, 1904, and ending December, 1906:

Books purchased	802	
Books by gift	1,726	
Total books		2,528

Pamphlets on exchange and by purchase	1,628	
Pamphlets by gift	1,953	
Total pamphlets		3,581
Total accessions		6,109

Present strength of the Library:

Books	15,580	
Pamphlets (estimated)	14,581	
Total		30,161.

The work of classifying and cataloguing the books according to the latest Library methods has practically been completed. The usual routine work in the Library has been accomplished. The 2,528 new books have been accessioned, classified, catalogued and shelved. The 3,581 pamphlets have been filed. The current periodicals have been checked and filed and the completed volumes bound and shelved as reference books. The catalogue cards received from the United States Department of Agriculture and the Library of Congress have been received and filed. The public documents have been made accessible to those desiring them. Reference work in the Library has increased greatly because of the activity in debating and general research work along different lines. Demand for the loan of books has likewise increased.

Work Done.

Some progress has been made in completing the files of U. S. Government documents. With the exception of a few volumes we have a file of the Congressional Record since its beginning in 1874. The Congressional Globe file is not yet complete, but the library contains most of the now scarce volumes. At least a very substantial beginning has been made toward the collection of the sheep bound set of United States congressional documents.

With the exception of publications along agricultural lines no effort has been made to collect state documents of other states than Utah and these have been very difficult to obtain. A more strenuous effort will be made to collect these Utah

state publications the coming year. Such a collection would be of much interest and value to the state.

In the administration of the library every barrier possible is removed between the students and the books. They have free access to the shelves and there are no fines demanded as long as the books are returned in good condition and within a reasonable time. As far as possible each one is taught the general arrangement of books and some individual attention is given to their instruction in the use of reference books. In the purchase of new books those are chosen which will be of the greatest assistance in their work and preparation for life.

From the list of donors to the Library we select only a few for particular mention.

The Agricultural College Woman's Club presented a life size Caproni cast of the "Discobolus."

Gifts.

The Wisconsin State Historical Library has presented the Library with 269 carefully chosen volumes from their duplicate collection. Many of these books could not be obtained by purchase. Other libraries and institutions have been very generous in their gifts and from private citizens smaller gifts of books and magazines have been received.

As nearly as can be estimated the Library will require for the new books which will be received during the coming two years, three new steel stacks.

Requirements.

The expense of binding will become a considerable item this year. Having completed many of the files of the United States agricultural department publications which consist mainly of small bulletins published from time to time, it will be necessary to preserve them. This is the most necessary literature for an agricultural library and must be kept complete. The Experiment Station bulletins should also be bound as soon as complete volumes are acquired. To bind these files will require about $300. On account of the increased use of the library, the necessity is emphasized of re-binding books which, added to the binding of the periodicals regularly taken by the library and afterwards shelved for reference books, will make the cost of binding probably $700 for two years.

Because of the great demand for necessary technical books by the department the humanitarian side of the library is rather neglected as the College offers more particularly the

technical courses, these are the ones that the Library must support first to the neglect of philosophy, religion, philology, history and literature. However, we will hope and urge that enough money be provided for all classes of literature, that the Library may become and continue to be a well rounded collection of books. In order then that further growth may be assured, larger financial resources must be obtained.

The Library should have about $2,500 a year for books for the next two years.

The following is an estimate of the general needs of the Library for the next two years:

Miscellaneous equipment	$150
3 steel stacks	300
Supplies	100
Total	$550

Respectfully submitted,

ELIZABETH C. SMITH,
Librarian.

REPORT OF THE REGISTRAR.

To the President of the College,

Statistics of Students.

SIR:—The registration of students during the past two years shows that the work of the College is giving satisfaction to the people, and is appreciated by them. Comparing the attendance of 733 in 1904-1905, with the attendance of 663 in 1905-1906, one would naturally feel that we are losing ground; but when it is remembered that in the latter year we were virtually without a Mechanic Arts Department for several months, and that many young men either remained away or went elsewhere, the falling off is easily understood. Thus far, for the present year, the registration is gratifying, the comparative figures, for December 10th, being:

1904-1905	580
1905-1906	551
1906-1907	604

Students are still registered almost daily, and if the attendance at the Winter Courses is at all up to other years, 1906-1907 should see the highest enrollment the College has ever had.

The following tables give a summary of students:

1. By Years.	Students 1904-1905.		Students. 1905-1906.	
Graduates	2		11	
Seniors	20		3	
Juniors	7		9	
Sophomores	14		30	
Freshmen	49		46	
Specials (with College rank)	15		33	
Fourth year (rank of Freshmen)	7		3	
Third Year, (rank of Freshmen)	31	145	12	147
Fourth year	7		7	
Third year	25		22	
Second year	116		123	
First year	219		162	
College Preparatory	91		61	
Sub-Preparatory	37		36	
Winter Courses	79		64	
Optionals	4		9	
Summer school	21	599	36	520
		744		667
Number of names repeated		11		4
Total registration		733		663

2. By Courses.				
Agriculture	115		108	
Domestic Science and Arts	131		113	
Commerce	142		127	
Engineering and Mechanic Arts	168		136	
General Science	21		30	
Music	8			
Specials			20	
College Preparatory	91		61	
Sub-Preparatory	40		36	
Summer school	21	737	36	667
Names repeated		4		4
Total registration		733		663

3. By Residence.

Utah:	1904-1905.		1905-1906.	
Beaver	4		4	
Box Elder	22		32	
Cache	266		238	
Carbon	5		4	
Davis	22		12	
Emery	1		2	
Grand	0		1	
Iron	1		1	
Juab	15		11	
Kane	2		2	
Millard	5		6	
Morgan	4		4	
Rich	13		6	
Salt Lake	32		27	
San Juan	1		0	
Sanpete	39		33	
Sevier	16		12	
Summit	8		13	
Tooele	5		9	
Uintah	12		2	
Utah	39		22	
Wasatch	4		6	
Washington	11		7	
Wayne	1		4	
Weber	45	—573	49	—507
Alaska		1		0
Arizona		2		4
California		1		0
Colorado		1		3
Idaho		114		108
Iowa		0		1
Louisiana		1		0
Maryland		2		2
Montana		5		6
Nebraska		1		2
Nevada		5		6
New Mexico		2		0
Oregon		5		6
South Dakota		0		1
Wyoming		18		11

Canada	0	2
England	1	0
Mexico	0	4
Russia	1	0
Totals	733	663

The following table indicates the number of graduates, with degrees and with certificates, from each of the schools during the past thirteen years:

Year	Agriculture: High School	Agriculture: Degree	Domestic Science: Hi. School	Domestic Science: Man'l Tr'g in Dom'c Ar.	Domestic Science: Degree	Commerce: Hi. School	Commerce: Degree	Gen. Sci.: Degree	Engineering & Mechanic Arts: Civil Engin'ing	Engineering & Mechanic Arts: Mech'l Engin'ing	Engineering & Mechanic Arts: Man'l Tr. in Mech. Arts	Total
1894	2	1		2	1	7	1	1	2			17
1895		1				3			1			5
1896		3				2		1	2	1		9
1897	1	1			5	2	3	4	1			17
1898					2	1	1	1		1		6
1899		1			1	4	4	1	4		3	18
1900				3	2	2	1	1	3	1	1	14
1901				1	1			3	1		1	7
1902				1		3		2		1		7
1903		1	1	6	2	2		2	5		2	21
1904		1	2	6	2	5	2	5	3	1	2	29
1905	1	2	1	7	4	7	4	4	4	1	2	37
1906	3		5	5	1	6	1		1		2	24

Total Certificates 104
Total Degrees 107

Respectfully submitted,
JOHN T. CAINE, JR.,
Registrar.

AGRICULTURAL EXPERIMENT STATION.

To the President of the College,

SIR:—I submit herewith a report for the Agricultural Experiment Station in which, under the several subdivisions, I first review briefly the activities and incidents in the experiment station work for the past two years. This is followed under each heading by an outline of the plans for the next biennial period, together with estimates of the funds which need to be provided by the State to secure the real estate and real estate improvements necessary to the most advantageous use of the federal appropriations for experimentation and to carry on the distinctive lines of investigation which the State had undertaken.

Historical.

The Sixteenth Annual Report of the Experiment Station is now in press, and the Seventeenth Annual Report is in preparation. In these will be found a more detailed report of the work for the last two years.

GENERAL SCOPE OF THE STATION ACTIVITIES.

The past two years have witnessed a considerable expansion in the means available for experimentation in agriculture in this state. Besides the home station and the six arid farm sub-stations which were previously provided for, the last legislature provided for placing the management of the Southern Experiment Farm with the officials of this Station, for the establishment of the Central Experiment Station, also to be under the management of this Station, and for special work in irrigation and drainage to be carried on within the State by this Station in co-operation with the United States Department of Agriculture. Besides these additional facilities furnished by the State, the federal government has placed at our disposal additional funds by the passage of the Adams Act by the last Congress. Additional investigations within the State were made possible by entering into co-operative arrangements with several bureaus and offices of the United States Department of Agriculture. This is highly gratifying because such co-operation, besides conducing to greater success

through combination of efforts, is also advantageous to us in that it results in more investigations being carried on within the State, thus benefiting, above all, the citizens of the State. It is advantageous also in that it gives a better opportunity to correlate the results from various states in which similar lines are carried on. It is our aim to continue, if possible, all these lines of co-operative work, with the exception of the alkali reclamation experiment, which we hope to bring to a successful close next spring. All these added lines of work, whether arranged for by acts of the state legislature, or by co-operative agreements between this Station and bureaus of the Department of Agriculture, and when carried out wholly or in part by the regular Station staff and by the use of the Station laboratories and office equipment and facilities, add relatively small amounts to the total expenses for administrative and scientific staff, and for laboratory and office supplies.

Federal Co-peration.

Just at present, one of the greatest difficulties in the administration of Station work is the securing and retaining of qualified specialists as heads of departments and assistants, men who are well grounded in the fundamental knowledge of their subject, and who have had experience in research work which demonstrates their ability to plan and carry out a scientific investigation, who are familiar with the practical side of farming, who have the appreciation of the responsibilities of their positions, and who have the proper attitude for mutual co-operation with other agencies within the institution and the State for the upbuilding of the agricultural industry. With the expansion of the Experiment Station work in every state of the Union, made possible by the enactment of the Adams Act by the last Congress, and with the rapidly increasing work of the Department of Agriculture, there arises such a demand for trained research men that it results, in practically every state, in making many changes in the personnel of the station staffs. In this scramble for men, the less wealthy stations are at a decided disadvantage unless they adopt the policy of contenting themselves with employing fewer men and establishing fewer departments so that sufficiently high salaries can be paid to place the positions here in effective competition with similar positions in the more wealthy states. With these facts in view, and recognizing also that the learned professions and expert work in all lines are better paid now than they were

Station Workers.

a few years ago, the salary scale has been advanced during the last few years, and should doubtless be advanced still more.

With the funds available in the past for salaries, it has been impossible in many cases to retain some of our best men. Efforts should not be spared to make the right kind of workers in the Station secure in their tenure of office.

THE WORK AT THE HOME STATION, CARRIED ON BY FEDERAL FUNDS.

As heretofore, the work in the Animal Husbandry, the Poultry and the Entomological Departments and part of that in the Agronomy, the Horticultural, and the Chemical Departments was carried on by federal funds.

In the Animal Husbandry Department, effective work was done in methods of feeding and the care of stock, and in improving the general conditions for the herd of cattle.

The poultry work was seriously handicapped by our not having a Poultry Manager during one year. At present, however, that department is rapidly recovering its former prestige and entering upon a far greater field of activity.

Departments.

It is proposed to start, under the supervision of the Poultryman, some demonstration work, and possibly some experimental work in fish-culture, provided suitable arrangements for a water supply can be made.

During the last year, time and means were placed at the disposal of the Entomologist for about three-fold as extensive experimental work as in former years. Besides a continuation of codling moth, grasshopper and some other lines of work previously started, an investigation of sugar beet pests was begun this year.

The Horticultural Department was largely occupied with the Central and the Southern Experiment Farms and to a lesser extent, with irrigation investigations. Some minor lines of work were carried on by this Department, including principally variety testing at the home station and at Brigham City. The melon testing work previously inaugurated at the latter place in co-operation with the Bureau of Plant Industry was continued through the season of 1905.

The work of the Agronomy Department also continued to be mainly under special funds, i. e., in the Arid-Farming and the Irrigation Investigations. Some work was done in variety testing and some in special co-operative lines. The Alkali

Reclamation Work in co-operation with the Bureau of Soils was continued. We expect to be able to turn this tract over to the owner as reclaimed next spring. The Sugar Beet Seed Improvement Work in co-operation with the Bureau of Plant Industry has also continued through the last two years and will continue next year. Some variety tests in alfalfa are being made in co-operation with the Bureau of Plant Industry. Some of the most promising varieties from this and foreign countries are given a test. Both of these lines will have to continue a number of years to yield results of value.

The Chemical Department joined, in its work, with nearly all departments of the Station, and under all the funds. Its main work, however, was along the lines of irrigation investigations, arid farming, and soil surveys of sub-stations.

In the sugar beet improvement work it has fallen to this department to test hundreds of individual beets in the selection of the best for mother beets. Many miscellaneous samples continue to come in, but we try to eliminate this phase of the work as much as possible, rejecting samples, the analysis of which have private interests only, even though they are of an agricultural character.

A year ago the scope of the work of the Station was increased by the creation of the Department of Veterinary Science and the appointment of a Veterinarian. Investigations will be carried on by the Veterinarian which ultimately must prove of great value to the stock interests of the State. A number of diseases are more or less prevalent among the domestic animals of the State. Some of these are not yet well understood and need investigation. One such is the disease locally known as "bighead" in sheep. This we planned to investigate this year, but were unable to get hold of a case, though last year many cases were known to exist. The Bureau of Animal Industry has arranged to co-operate with us in this investigation in case we find the disease. We expect next season to work on this disease if it appears. There have been numerous calls, mostly by the State Board of Health, for our Veterinarian to investigate supposed cases of such diseases among stock as endanger public health or threaten epidemics among stock. Such work is not research work and does not come within the province of experiment station work. It belongs to the duties of a state veterinary inspector. We have temporarily, to some extent, responded to this demand, but we

State Veterinarian.

recommend that such an office be created in the State, and that if deemed advisable, arrangements might be made for our veterinarian to give part of his time to that office.

Quite recently another new department was added, viz., the Dairying Department. Of late years, very little experimental work has been done in dairy manufacture. It is hoped that we can now push this work as well as dairy production to the greater prominence which its importance in the State justifies.

The Adams Act.

The addition of this new department, as also a very material expansion of all other previously existing departments, is made possible by the passage of the Adams Act, which added five thousand dollars last year to the federal fund available to the State Experiment Stations. This added amount is to be increased each succeeding year by two thousand dollars until in five years it reaches fifteen thousand dollars, thus doubling the amount formerly available through the Hatch Act. By these increased amounts in future years, we expect first of all to further strengthen existing departments; then, as soon as possible, to add a few new departments. We are now much in need of specialists in bacteriology, in plant pathology, and in soil physics, and of a Station Mechanician.

In the passage of the Adams Act, Congress took occasion to define more clearly what should be the relation between the State and the federal government in respect to the work of experiment stations. It had been the general understanding that the states were to furnish the home, i. e., the buildings and grounds for the experiment stations. There is express provision made in the Hatch Act that no large portion of the Hatch Fund could be so used. There is also a strong prevailing sentiment among the leaders in agricultural research against using the federal funds of the stations extensively for publications, especially such publications as are purely for instruction not closely connected with the results of the experimental work done by the station. There always has been and there is yet great need for the distribution of such general instructional literature. The stations have in part responded to this need, but the modern tendency is for the states to provide funds for it. The same might be said of illustrative or demonstrative experiments. In the passage of the Adams Act and its administration by the Department of Agriculture, explicit limitations are set, that the Fund shall not be for general maintenance, for care of buildings or for the printing and dis-

tribution of publications. Secretary Wilson said in this connection: "The increased liberality of the Federal Government in providing for the endowment of research and experimentation in agriculture should be a further incentive to the States and local communities to supplement these funds for the extension of demonstrative experiments, farmers' institutes, agricultural colleges, schools and courses of instruction, and the general education of the rural communities along industrial lines, in order that the masses of our farmers may be so educated from early youth that they will appreciate the benefits of original research and experimentation as applied to agricultural problems, and be able to appropriate in the most effective manner for their own benefit and the general welfare of the Nation whatever practical results are obtained from the work of the agricultural experiment stations." I believe, therefore, that in urging that the State furnish such buildings and grounds as are needed for experimental work, provide the fuel, light, janitorial service, etc., needed for their general maintenance, and provide a liberal fund for printing, I am acting entirely in harmony with the spirit of the times. Fortunately not much is urgently needed in the way of new buildings at the Home Station for the experimental work for the next biennium. We find ourselves restricted, however, in our experimental work in the Poultry and Animal Husbandry Departments this year for want of a few, relatively inexpensive, buildings. In the creamery, improvements in the refrigeration plant called for by the Dairymen are also needed for properly carrying on contemplated experiments. In the veterinary science work, some of the most important lines of investigation that we contemplate undertaking require isolation which calls up a long felt need of an isolation hospital. This building, of course, is not exclusively for the Station, but is also at times needed for the college herd and for the clinical work in veterinary science. Estimates on this are doubtless included in Veterinarian's report, and for that reason are here omitted.

Purchase of Land.

I call your attention to the fact that nearly three years ago a contract was entered into between the Board of Trustees of this Institution and John Fankhauser of Logan for the rental, with the option of purchase, of a tract of 5.15 acres adjacent to our Greenville Farm. As this contract expires January 1, 1909, it is highly important that provision be made by the next Legislature to purchase. It will be a great misfortune, if, because of inaction at this time, this option should be allowed

to expire without securing title to the tract. The price of land in this vicinity has advanced so that we could hardly hope, without the option, to secure this or any other similar land in the vicinity at nearly so low a price. Most of all, however, there is necessity of securing title to this tract because over a thousand dollars worth of improvements in the way of flumes, weirs, etc., and one hundred or more dollars worth in leveling the tiers of plats have been put onto it. These sums would be worse than lost, since in turning the land back to Mr. Fankhauser, we would be at great additional expense to remove the flumes, and to bring the field back to a uniform grade.

We rejoice that the State in the past has been liberal in providing heat, lights, and janitorial service for the station offices, and, in certain years, a publication fund, and hope that such may continue. That the cost of maintenance may be completely assumed by the State, I urged that the gasoline needed for gas in the various laboratories be also wholly provided by the State. This would amount to about $600 for gasoline in addition to what the college has heretofore furnished.

Needs.

Summary of estimates for minor buildings, land, improvements, and publications:

Colony houses for Poultry Department	$ 225	
Incubator cellar with house covering the same	500	
Fencing of Poultry Department	200	
Tree planting about the Poultry department	100	
Fish pond	100	
Sheds for steer feeding	1,500	
Sheds for sheep feeding	600	
Movable pig houses	250	
Improvements in refrigerating plant of the Dairy Department	175	
Miscellaneous buildings and improvements not now foreseen	2,000	
Purchase of Fankhauser experiment grounds at Greenville, as per terms of contract	750	
Publications, two years	3,000	
Total		$9,400

ARID FARM INVESTIGATIONS.

The six Experimental Arid Farms established by the Legislature four years ago have now produced their third crops. The main thing thus far accomplished is to awaken the people of the State to the possibilities in arid farming. In this respect we believe the highest expectations of that Legislature have been realized. The acreage brought under cultivation as a consequence of these experiment farms, the added wealth brought to the people, and the increased receipts brought to the State Treasury, amply justify the expenditures incurred by the State.

Importance of Continuing Experiments.

If the objects in the establishment of these farms were merely to determine whether or not arid farming can be made a paying business in those localities, then in most cases the experiment might now be considered completed. But that was only one of the objects. What varieties of crops and what methods of handling them are the most profitable, is the question for the answer to which most of the work is being done. With three years data before us, we begin to see some fairly definite indications along these lines. We hope early this winter to get ready for distribution a bulletin on these data. In many of the lines under investigation, however, we find the data now on hand far from conclusive, nor will the data of one additional year give us sufficient grounds for safe conclusions. Besides, investigations are being started each year on some new problems. Many problems have already presented themselves for which we cannot at present find room in our scheme of experiments. We deem it, therefore, highly important that these farms, at least most of them, be continued for experiments in arid farming. It might be advantageous to put about two of the farms more nearly on a commercial basis, run them at greatly reduced expense, and with the funds thus saved do more thorough work on the others. We find it difficult, at the wages which we can afford to pay, to get reliable men to do the work and report the results properly. On the commercial farms, we would then propose to use such crops and apply such methods of handling them as have proven most successful on the experimental farms. These crops would be put on strips across the farm instead of the usual small experiment plats. The purpose of the commercial farms would be to further test the adaptability of the

soils and climate represented for dry farming and to test on a more extensive scale the conclusions drawn from the plat experiments on the other farms. It is to be noted that the law creating these experimental arid farms provided for their maintenance for only five years. As one year was used in getting ready for crops, there is provision made for only four crops. As this time expires in another year, it devolves upon the next Legislature to provide for the continuation of the work, in such form as it sees fit. If it sees fit to extend the work, then I suggest that commercial trials as above outlined in some other untried localities, would be very desirable both to determine whether dry farming could be a success there, and to demonstrate to the people the best methods of carrying it on. I estimate that about $600 a year would be sufficient to carry on such a farm after the improvements and implements are paid for, and that for these about $300 additional would be needed during the first year.

We have been much handicapped for the want of certain machinery and shelter for it on some of the existing farms, and on account of the uncertain tenure of these farms we have held off providing these necessities. If it can now be decided to continue them indefinitely, then we can plan more advantageously the equipment.

Another matter which comes up almost invariably with the subject of arid farming, and which might very appropriately receive Legislative consideration, is the developing of water supply for working animals, engines, culinary purposes, and general livestock. To haul the water long distances for these purposes prohibits making homes on the farm, and may even prohibit profitable farming. Would not State aid to explorations conducted by some expert hydrographer be justifiable?

Appropriations needed for arid farming investigations,—general maintenance of six farms (including also additional machinery and shelter)—same as in last biennium, $15,500.

SOUTHERN UTAH EXPERIMENT FARM.

When the management of the Southern Experiment Farm was turned over to this Station, the farm was largely occupied by horticultural crops, principally orchards and vineyards used in the variety tests. These variety tests were continued and extended to additional varieties. Some work was

done in testing cover crops for the orchards. A soil survey was made, which is practically complete now. The results of this survey will be published in the forthcoming report of this sub-station, which is in preparation and will be published as a bulletin of the Experiment Station. To this report, when complete, you are referred for more details regarding the work at this farm. The more immediate supervision of the work from the side of the Station Staff has fallen to the Station Horticulturist. This includes most of the planning of new experiments, and, through the foreman, the employment of labor, the purchase of supplies, the disposition of crops, etc.

Historical.

The soil survey shows a large amount of soluble salts to exist in the soil. This fact, considered in connection with the history of the fields just west of the farm, make it almost certain that sub-drainage will have to be resorted to in order to save the farm. In the co-operative drainage investigation which this Station and the United States Department of Agriculture are carrying on one experiment was installed in the fields adjacent to the experiment farm and a deep outlet drain is now planned to be put in which will reach the lower side of the farm. For the drainage of the farm, a special sum of about $400 should be provided. Aside from this, it seems to me the same sum as that appropriated for the last two years would suffice for the next two years, viz., $6,000.

Drainage.

CENTRAL UTAH EXPERIMENT STATION.

Owing to the lateness of the time of deciding on the location of this farm, no work was done on it during the first year. During the last season the work has been rushed to get as much of the experimental work started as possible. The lateness of the opening of the spring and the consequent short time for preparing the ground for setting out nursery stock, further limited the amount of orchard started. About twenty acres of the ground were levelled off at a considerable expense, nearly ready for orchard planting. Of this about seven acres are for commercial varieties to demonstrate the profitableness of the orchard business. The remainder is for irrigation investigations with orchard. As the nursery stock made very rapid growth before the levelling was completed, the greater portion of it was put into nursery rows to carry it over the season. Five and one-half

Historical.

acres of the commercial orchard were set out. Several acres also were set out in small fruit. This special effort early in the season was made in order to get as much as possible of the proposed orchard area ready and set out in trees, because it was realized that the orchard work was the most important that need be taken up at this sub-station, and that at best it would require a number of years before results would come from these tests.

In providing the work team and the farm implements needed, due consideration was given to the permanent character of the farm, and it was the aim to procure extra good equipment.

On the lower ground near the State Road the Agronomy Department carried on some experiments on crop rotation and the Entomology Department in combating sugar beet pests. In the old orchard spraying experiments were carried on. The areas not used in any of these experiments were utilized to the best advantage for crops like alfalfa, oats, and potatoes, to supply feed for the team and produce for sale.

Building.

A sum estimated to be sufficient for a foreman's cottage was set aside for that purpose, but recently when the bids were submitted it was found that we could not get a suitable cottage constructed for that sum. Plans and specifications were prepared for a one and one-half story brick cottage with seven rooms, inclusive of an office, but exclusive of pantry and bath room, and with cellar and two porches. The specifications called for a first-class structure. We advertised for bids on four propositions, viz., first the house complete; second, the house complete except that the upstairs be unfinished; third, the house complete except that the kitchen with one porch, the pantry, the bathroom and basement be left off; and fourth, the house complete except that the upstairs be left unfinished and the kitchen, etc., left off. On the first call for bids we got only one response, and this bid was too high even for the cheapest of the four propositions for the means set aside, and was, therefore, rejected. We again advertised more extensively by inserting notices in two Utah County papers, one Salt Lake City paper, and one Logan paper. This brought in bids from two more contractors, but they were higher than the bid first received. The bids were as follows:

Proposition.	First Bidder.	Second Bidder.	Third Bidder.
1st House complete	$3,985	$4,950	$5,650.75
2nd With upstairs incomplete	3,535	4,450	5,560.25
3rd With kitchen, etc., omitted	2,995	3,700	5,498.50
4th With upstairs incomplete and kitchen, etc., omitted	2,680	3,350	5,275.50

For the same reason as before these bids were all rejected. It is now planned to use the reserved building fund for a barn, an artesian well and other needful improvements.

A soil survey of the farm has been started. Nearly all the samples are taken. The balance will be taken this fall or winter.

In the following list I estimate the requirements for the next two years:

General maintenance, two years	$ 8,000	
Residence for foreman	4,000	
Permanent fencing around the farm	400	
Flumes for irrigation orchard experiments	600	
Miscellaneous improvements	500	
Total		$13,500

All this, excepting one-half of the maintenance fund, should be made available during the first year of the biennium. A report on this farm, discussing the location, outline and topography, the equipment secured, the improvements made, and the experiments outlined, will be prepared as soon as those in charge can find the time to do so, and will be published as an Experiment Station bulletin.

IRRIGATION AND DRAINAGE WORK.

The arrangement under which this work is now being carried on is for the State of Utah and the United States Department of Agriculture to furnish like amounts of the funds and, with these funds, this Experiment Station and the Office of Experiment Stations of the Department of Agriculture to co-operate in the investigations. By the present arrangement, the State appropriated $5,000 for each of the last two years and the Department of Agriculture appropriated a like

amount. These funds will be fully consumed in carrying to completion the work undertaken for these two years. Each year there were three main lines of work in progress, the Greenville irrigation work with small plats, the outside irrigation work, in which larger plats or areas were the units of comparison, and the outside drainage work. In each of the two years the Greenville work was under the immediate supervision of the officials of this Station and the drainage work under that of the officials of the Department of Agriculture.

Historical.

Last year the outside irrigation work, after its inauguration, was also in charge of the Department employees and this year is in charge of the Station employees. We were this year enabled to carry on more extensive outside irrigation investigations through the co-operative arrangement with the State Engineer, whereby the Engineer's office contributed part of the funds needed for duty of water investigations along the Weber River, that office also benefiting in the data coming from the work.

In the Greenville work some problems are considered solved and are, therefore, dropped and others started in their stead. Some changes were made in the details of the plans this year. In the outside irrigation work similar experiments to those carried on at Greenville were conducted on a larger scale. This took the work into many different localities in the State and, therefore, into a great variety of climatic and soil conditions. Two drainage projects were started last year, one near Huntington and one near St. George. These are very promising. The one near St. George is being extended this year, and others are being installed.

From a recent communication from Washington, we learn that the officials of the Department of Agriculture are favorably disposed to renewing this co-operative arrangement for another two years. The State should certainly not let this opportunity pass. Besides the lines of investigation already started and not completed, there are a number of new lines that should be started.

Further Co-operation.

Among such I wish to mention especially winter irrigation. We hope to be able to start some work in this line this fall, taking our chances at provision being made to continue the work next year.

To avoid possible trouble or confusion on a technicality, I recommend that a slight change be made in the State law referring to this co-operative irrigation and drainage investiga-

tion. I recommend the omission of Section 3 of the Act, entitled "Investigations of the use of irrigation water and the reclamation of alkali lands," approved February 21, 1905, and the amendment of Section 6 to read as follows:

"Appropriation.—That for the purpose of carrying out the provisions of this act, $10,000 be appropriated from any moneys in the State Treasury not otherwise appropriated, $5,000 of this sum to be available in 1907, and $5,000 in 1908, the expenditure to be conditioned on the Office of Experiment Stations appropriating and expending a like sum."

As herein indicated, the appropriation needed for this work is the same as for the last biennium, $10,000, by the State.

PUBLICATIONS.

There have been published since the last biennial report was written, six bulletins, one press bulletin, and four circulars, numbered and entitled as follows: Bulletins, No. 91, Arid Farming in Utah; No. 92, Poultry Investigations; No. 93, Agricultural Reconnaissance of the Uinta Indian Reservation; No. 94, Summary of Pig Feeding Experiments; No. 95, Codling Moth Work in 1904; No. 96, Care of Milk on the Farm and the Manufacture of Butter and Cheese. Press Bulletin No. 11, Extermination of Prairie Dogs. Circulars: No. 3, Memoranda of Plans of Arid Farm Investigations for 1905; No. 4. Memoranda of Plans of Irrigation Investigations for 1905. Copies of these publications will be handed you herewith. A few other bulletins are in preparation and will be published in the early part of the winter..

Respectfully submitted,

P. A. YODER,
Director Utah Experiment Station.

FARMERS' INSTITUTES.

Held Jan. 1, 1905, to Dec. 18, 1906.

Date.	City.	County.	Approximate No. Present.	
1905.				
April 11	Ephraim.	Sanpete.	130	(2 Meetings)
April 12.........	Ephraim.	Sanpete.	360	(3 Meetings)
April 14.........	Monroe.	Sevier.	292	(3 Meetings)
April 15.........	Monroe.	Sevier.	160	(2 Meetings)
June 29 & 30..	Randolph.	Rich.	600	(4 Meetings)
December 12..	Mt. Pleasant.	Sanpete.	170	(2 Meetings)
December 12..	Gunnison,	Sanpete.	60	
December 13..	Manti.	Sanpete.	750	(3 Meetings)
December 14..	Monroe.	Sevier.	90	
December 15..	Monroe.	Sevier.	76	(2 Meetings)
December 15..	Junction.	Piute.	30	
December 15 .	Marysvale.	Piute.	25	
December 15..	Richfield.	Sevier.	250	(2 Meetings)
December 16..	Ephraim.	Sanpete.	230	(2 Meetings)
December 16..	Fairview.	Sanpete.	100	(2 Meetings)
December 18..	Beaver.	Beaver.	40	
December 18..	Beaver.	Beaver.	120	(3 Meetings)
December 18..	Fillmore.	Millard.	125	(2 Meetings)
December 19..	Lehi.	Utah.	350	(2 Meetings)
December 20..	Spanish Fork.	Utah.	150	
December 20..	Levan.	Juab.		(4 Meetings)
			4,108	

Date.	City.	County.	Approximate No. Present.	
1906.				
January 23.....	Elwood.	Boxelder.	150	
February 23...	Nephi.	Juab.	271	(2 Meetings)
February 24...	Nephi.	Juab.	342	(3 Meetings)
February 26...	Beaver.	Beaver.	260	(2 Meetings)
February 26...	Moroni.	Sanpete.	172	(2 Meetings)
February 26...	Spring City.	Sanpete.	71	
February 27...	Fairview.	Sanpete.	43	
February 27...	Mt. Pleasant.	Sanpete.	143	
February 27...	Parowan.	Iron.	180	
February 28...	Cedar City.	Iron.	410	(2 Meetings)
February 28...	Salina.	Sevier.	90	
February 28...	Ephraim.	Sanpete.	56	
March 1.........	Monroe.	Sevier.	93	
March 1.........	Richfield.	Sevier.	92	
March 2.........	Elsinore.	Sevier,	45	
March 2	Monroe.	Sevier.	150	(2 Meetings)
March 1.........	Smithfield.	Cache.	60	
March 10.......	Logan.	Cache.	25	
March 27.......	Kaysville.	Davis.	305	
March 28.......	Huntsville.	Weber	69	
March 29.......	Farmington.	Davis.	67	(2 Meetings)
March 29.......	East Bountiful	Davis.	7	
March 31.......	Riverton.	Salt Lake.	17	
March 31.......	West Jordan.	Salt Lake.	26	
March 31.......	Morgan.	Morgan.	73	(2 Meetings)
March 31.......	Benson.	Cache.	15	
March 2.........	St. George.	Washington.	124	(2 Meetings)
March 3.........	St. George.	Washington.	42	
March 25.......	North Ogden.	Weber.	42	
March 25.	Five Points.	Weber.	52	
March 26.......	Hooper.	Weber.	47	
March 26.......	Wilsons.	Weber.	68	
March 27.......	Plain City.	Weber.	42	
March 27.......	West Weber.	Weber.	33	
November 19..	Loa.	Wayne.	85	
November 20..	Koosharem.	Piute.	75	
November 22..	Panguitch.	Garfield.	100	(2 Meetings)
November 23..	Hatch.	Garfield.	25	
November 24..	Glendale.	Kane.	15	
November 20..	Kanab.	Kane.	32	
November 27..	Rockville.	Washington.	100	
November 30..	St. George.	Washington.	40	
December 1...	Toquerville.	Washington.	40	
December 2...	Kanarra.	Iron.	40	
December 3...	Parowan.	Iron.	50	
December 4& 5	Beaver.	Beaver.	40	(2 Meetings)
December 6...	Hinkley.	Millard.	85	
December 11..	Mt. Pleasant.	Sanpete.	52	
December 12..	Glenwood.	Sevier.	30	
December 13..	Richfield.	Sevier.	32	
			4,523	

Attendance at meetings held after July 1, 1905, was determined in nearly every case by actual count.

SUMMARY.

Number of meetings	106
Approximate total attendance	8,631
Approximate average	85

REPORT OF SUPERINTENDENT OF BUILDINGS.

To the President of the College,

SIR:—I herewith submit my report as Superintendent of Buildings for the biennial period ending Nov. 30, 1906.

The most important item under buildings during the last biennium has been the restoration of the Mechanic Arts buildings, which were destroyed by fire on September 11, 1905.

Historical.

The principal contracts for rebuilding were awarded to Messrs. Worley & Nelson, and Messrs. Nelson & Bjorkman. The total cost of the buildings has been $22,901.11. The present buildings are far superior in every way to the old ones.

The east wing of the Cattle Barn has been completed and new tie sheds for the accommodation of the public have been built at an aggregate cost of $3,178.

The Greenhouse has been more than doubled in capacity and made more suitable for class and experimental work at a cost of $3,710.14. It is not quite completed as yet.

The repairs and miscellaneous improvements during the past seventeen months are classified as follows:

Dormitory	$ 664.60
Main building	2,744.44
Residences	731.19
Shops	258.42
Barns	164.45
Poultry house	276.90
Greenhouse	92.62
Fencing	126.09
Painting	1,675.27

Plumbing	247.17	
Steam Heat	155.75	
Electric Plant	247.60	
Unclassified	1,009.75	
Experiment Station Building	427.00	
Total		$8,821.25

It will be noticed that the main building and painting are the heaviest items. Fire protection has been provided on each floor of the main building at a cost of about $500.

The floors in the kitchen and in other parts of the main building have for a long time been very unsatisfactory, and, after thorough consideration of the matter, the building committee ordered nearly all the floors to be re-laid in the north and south halls and in the kitchen, and that the roofs on nearly all of the buildings be painted, and the vault in the old office of the Secretary be moved to the Station Building, thus enlarging two class rooms and giving the Station the use of the vault which was badly needed. It should also be mentioned that the Station Building is now in good condition. It has been provided with a good basement, with an excellent vault for records, and with splendid facilities for mailing and for photographic work. I might also mention that a new line of electric and telephone poles has been run from the drive north of the horse barn to the farm buildings and the residences, replacing the old poles which belonged to the Telluride Power Company, but which now belong to the College.

The requirements for the next two years will be approximately as follows:

Steam Heating.	Extension of smokestack for main building	$ 300	
	Repairs on boilers	100	
	General repairs on steam plant	200	
	New boilers for Dormitory	450	$1,050
Waterworks	General repairs on water works system	250	
	For fire protection:		
	Hydrant between cattle and sheep barns, including main 200 feet long	250	
	500 feet 2½-inch hose and hose cart	245	

	One small brick building to keep cart and hose, keys, valves, etc.	150	
	250 feet. 4-inch pipe to put hydrant east of Mechanic Arts building	400	
	Extending hydrant to north cottage	75—	1,370
Sewerage.	New cesspool for main building	150	
	Pipe to connect sewer system with cesspool, including cost of laying	125	
	General repairs on system for two years	200—	475
General Repairs.	Locks, hinges, etc.	100	
	Tools, oil, pipe, and fittings for repair shops	150	
	Repairs on main building	500	
	Furniture	150	
	Windows, glazing, etc.	300	
	Plastering and calcimining	200	
	Window shades	50	
	Gas repairs	100	
	Electric lights	750	
	Dormitory and cottages	250—	2,550
Painting	Horse Barn	·240	
	Station building	75	
	Dormitory	450	
	Sheep barn	300	
	Cattle barn	500	
	Piggery	100	
	Poultry building	240	
	Painting stairways, oiling floors, etc.	300—	
	Main building	800—	3,005
	Fuel for two years		6,000
	Grand total		$14,450

Respectfully submitted,

C. Batt,

Superintendent of Buildings.

Estimated Requirements

—OF—

The Agricultural College of Utah

FOR THE BIENNIUM

July 1, 1907 to June 30, 1909.

SALARIES.

Salary list as per budget for 1906-1907..	$63,500	
For biennium on same basis		$127,000
Additional Assistants and Instructors:		
Dairy	840	
Animal Industry	1,000	
Botany	1,000	
Chemistry	175	
Zoology and Entomology	1,000	
Geology, Mineralogy, and Physics ..	500	
Mathematics and English	1,000	
Mechanic Arts	350	
	5,865	
For two years		11,730
Total salaries for two years...		$138,730

SUPPLIES AND LABOR.

Agronomy.		
Horse feed and miscellaneous		$ 600
Irrigation and Drainage.		
Miscellaneous supplies		100
Animal Industry.		
Feed for stock	2,000	

Halters, ropes, and incidentals	200	
Registration of livestock	50	
	2,250	
Labor	2,400	
	4,650	
Estimated income from livestock	2,500—	2,150
Dairying.		
Milk for creamery	$13,300	
Ice, coal, salt, etc.	700	
Record books, score cards, etc........	25	
Registration of pure bred animals ...	50	
Stationery, index cards, etc.	100	
Feed for dairy herd	1,000	
Labor	900	
	16,075	
Estimated income from dairy. 14,000		
Estimated income from dairy herd .... 1,000—	15,000—	1,075
Veterinary Science.		
Drugs and medicine		475
Bacteriology.		
Laboratory supplies		75
Horticulture and Botany.		
Coal	250	
Campus seeds, bulbs, plants, etc	400	
Labor	2,400—	3,050
Domestic Science and Arts.		
Supplies for cooking classes	1,500	
Supplies for laundry	200—	1,700
Commerce.		
Supplies for accounting	100	
Supplies for stenography	125—	225
Mechanic Arts.		
Coal, coke, iron and steel, lumber, paint, nails, screws, glue, etc.....	7,000	
Estimated income from sales	1,000—	6,000
Chemistry.		
Chemicals for two years	600	
Apparatus for classes	500	
Photographic supplies	150	

Gasoline	500	
Repairs	150—	1,900
Zoology and Entomology.		
General Supplies		200
Geology and Mineralogy.		
General supplies		100
Pyhsics.		
General supplies		300
Drawing.		
For art exhibit and general supplies ..		200
Music.		
General supplies		200
Military Science and Tactics.		
Target material and general supplies..		115
Library.		
General supplies		100
Secretary's Office.		
General supplies		525
Registrar's Office.		
Examination paper, printing, etc.		360
Janitorial and miscellaneous supplies		500
Total supplies and labor		$19,950

REPAIRS.

Animal Industry.		
General repairs		$ 400
Steam Heating.		
General repairs on steam plant and boilers		300
Water Works.		
General repairs of water work system		250
Sewerage.		
New cesspool for main building ......$	150	
Pipe to connect sewer system with cesspool	125	
Repairs on system for two years	200—	475
General Repairs.		
Locks, hinges, tools, oil, fittings, etc..	250	
Repairs on main building	500	
Repairs on Dormitory and Cottages .	250	

Furniture, windows, glazing, etc.	450	
Window shades, plastering and calcimining	250	
Gas repairs and electric lights	850	
Labor for two years	600—	3,150
Painting.		
Horse barn	240	
Dormitory	450	
Cattle and sheep barns	800	
Poultry building and piggery	340	
Main building	800	
Painting stairways, oiling floors, etc..	300—	2,930
Total repairs		$7,505

EQUIPMENT.

Agronomy.		
4 desks for Soil Physics Laboratory.$	600	
Museum cases and specimens of grasses, grains, etc., for museum	400	
2 analytical balances to be used for work with soils and moisture determinations	220	
2 special ovens for heating and drying plants and soils	40	
1 compound microscope	100	
Thermometers, beakers, flasks, and miscellaneous apparatus	60—	1,420
Animal Industry.		
Card index cases, live stock pictures, herd and record books		70
(See "Livestock.")		
Dairying.		
Record books and miscellaneous equipment	275	
New boiler in creamery	500—	775
(See "Livestock.")		
Veterinary Science.		
Instruments and miscellaneous equipment	575	
Charts, models, etc.	150	
'useum glassware and specimens	75—	800

Bacteriology.		
Two microscopes	225	
Steam sterilizer	40	
Autoclave	75—	340
Horticulture and Botany.		
10 sets of laboratory equipment for work room, spraying outfit, and miscellaneous material	350	
Lawn mower, hose, and campus tools	510	
Botany equipment, including microscopes, 6 camera lucidas, etc.	975—	1,835
Domestic Science and Arts.		
Rug $20, bookcase $20; desk $50	90	
Cabinet for H. S. collection	35	
Sideboard and table $60, chairs $20	80	
Additional laundry tubs	300	
Allowance for museum $50, silverware $60, linen $50	160	
Table china and glass	60	
4 sewing machines, chairs, and tables	165	
4 chiffoniers $50, stools, and cabinet	81	
Incidental equipment	72—	1,043
Mechanic Arts.		
Iron Machine Shops:		
2 engine lathes	800	
Counter shafts, belts, pulleys, and extras required in restoration of old machines damaged by fire	700	
Forge Shops:		
1 heating furnace	200	
1 tempering furnace	200	
1 annealing box	150	
Carpenter Shops:		
1 tennoning machine	400	
1 wood trimmer	150	
7 wood turning lathes	500—	3,100
Commerce.		
1 Remington typewriter	70	
General equipment	100—	170
Political Science and Industry.		
Filing cabiet	50—	50

Chemistry.		
Dynamo and storage batteries	100	
Stereopticon and slides	150	
Organic chemical specimens	200	
Additional tables for general chemistry	450	
Miscellaneous apparatus and furniture.	300—	1,200
Zoology and Entomology.		
Demonstration table with connections.	100	
Charts and skeletons	150	
Embryology material	150	
Microscopes	225	
Histology equipment	200	
Chemical case $30, aquarium $40	70	
Sink $30, glassware for museum $50..	80	
Breeding cages, and miscroscope slides	150	
Museum cases	150	
Specimens and mounting	200—	1,475
Physics.		
Laboratory fixtures	250	
Instrument cases	75	
One doz. Martin's measuring sets.....	100	
Eight sets of equipment for heat tests	400	
Eight sets of equipment for mechanics.	600	
Equipment to complete sets on hand...	720	
One solar stereopticon complete	100	
One work bench with tools	50	
Repairs on instruments	30—	2,325
Geology and Mineralogy.		
Paleontological specimens	150	
Relief models	200	
Museum cases and repairs	250	
Mineral specimens	100	
Microscope	75	
Expenses in collecting material	100	
Equipment for mineralogy	200—	1,075
Music.		
Two pianos	500	
Instruments for band and orchestra, including 2 saxaphones, baritone, and tuba	300—	800
Library.		
Steel stacks	300	
Miscellaneous equipment	150—	450
Books and binding		4,000

Physical Education.

20 chestweights	320	
Traveling parallel	60	
Back, loin and chest weights	26	
2 duplex intercostal chest weights	52	
Leg machine and horizontal bar	68	
3 mats $135, 8 doz. wands $13	148	
Finger and wrist machine and wand rods	24	
Neck machine and abdominal mat	42	
Set of measuring apparatus	193—	933
Secretary's Office.		
Filing cases, etc.		250
Total equipment for two years		$22,111

LIVESTOCK.

Animal Industry.

Team of Percheron mares and harness	$ 1,000	
Shorthorn females	700	
Hereford females	600	
Aberdeen Angus bull	300	
Aberdeen Angus females	600	
Shropshire ram and ewes	175	
Oxford ram and ewes	150	
Tamworth boar	35	
Yorkshire boar	35	
Berkshire boar and sows	125—	3,720
Dairying.		
3 Holstien cows and one bull	800	
3 Jersey cows and one bull	800	
2 Guernsey cows	400—	2,000
Total		5,720

IMPROVEMENTS.

Fences and paddocks	$ 350
Water troughs, and piping to cattle yards	250
Yards and individual houses for swine	150
Trees for pasture	25
Improving ice house and refrigerator in Dairy	175

Milk receiving platform	40	
Building yards for young dairy stock	200	
Changes in Veterinary Science hospital	100	
Storage room for chemistry	125	
Hydrant between cattle and sheep barns, including main 200 feet long	250	
Hose and hose cart	245	
Small building to keep cart and hose, keys, valves, etc.	150	
250 feet 4-inch pipe to put hydrant east of Mechanic Arts building	400	
Extending hydrant to north cottage	75	
New boiler and cement floor in boiler room of Dormitory	400	
Extension of smoke stack of Main building...	300	
Finishing rooms on fourth floor of main building	3,000	
Total improvements		$6,235

MISCELLANEOUS.

Water tax ....$	350	
Traveling expenses	500	
Telephone and telegraph	300	
Electric light and power	2,250	
Night Watchman	600	
Janitorial labor	2,500	
Postage and stationery	600	
Clerical assistance	500	
Printing	1,800	
Advertising	700	
Extension work	1,000	
Furniture and furnishings	200	
Unclassified	1,300	
Fuel	3,000	
Firemen	400	
	16,000	
Total for two years		$32,000
Insurance on buildings and equipment.....		2,500
Total miscellaneous		$34,500

Extra if Veterinary Science Course is established:

Salaries, Veterinary Science and Zoology..	$ 1,000	
Instruments and equipment for hospital ...	500	
Making changes in hospital	250	
Museum supplies, department supplies, drugs, etc.	300—	2,050

Extra if Irrigation Engineering Course is established:

Salaries	4,000	
Field instruments	450	
2 current meters	150—	4,600

SUMMARY.

Salaries	$138,730	
Supplies and labor	19,950	
Repairs	7,505	
Miscellaneous	34,500	
Equipment	22,111	
Livestock	5,720	
Improvements	6,235—	$234,751
Income:		
Government	$ 50,000	
Interest	18,000	
Fees	10,000—	78,000
Balance		$156,751

Extra if Veterinary Science Course established......	$2,050
Extra if Irrigation Engineering Course established...	4,600

EXPERIMENT STATION.

Cattle sheds and yards	$1,200	
Sheep sheds and yards	400	
Incubator cellar	500	
Silo	250	
Land	750	
Fencing, planting trees, etc.	500—	$3,600
Electric power and light, maintenance of buildings, etc.	2,500	
Printing	3,000—	5,500
Grand total		$9,100

INSURANCE.

COMPANY	Amt.	Rate	Prem.	Expires
MAIN BUILDING.				
Home Fire Insurance of Utah	$10,000	12.615	$126.15	6- 7-07
American Central of St. Louis	10,000	12.615	126.15	6- 7-07
London and Lancashire Fire	15,000	12.615	189.25	6- 7-07
Union Assurance Society	15,000	12.615	189.25	6- 7-07
Svea Insurance of Sweden	15,000	12.615	189.25	6- 7-07
American Central of St. Louis	15,000	12.615	189.25	6- 7-07
London and Lancashire Fire	10,000	12.615	126.15	3-19-08
Union Assurance Society	10,000	12.615	126.15	3-19-08
North German Fire of New York	10,000	12.615	126.15	8- 8-08
Svea Insurance of Sweden	10,000	12.615	126,15	8- 8-08
North German Fire of New York........	8,000	12.615	100.90	8- 8-08
Union Assurance Society	3,000	12.615	37.85	8- 8-08
MECHANIC ARTS BUILDING.				
The Buffalo-German Insurance Co........	2,000	12.00	24.00	4-11-09
National Mutual Fire Insur. Co., Omaha..	1,000	12.00	12.00	4-11-09
Ohio-German Fire Ins. Co., Toledo, O....	1,000	12.00	12.00	4-11-09
Girard Fire and Marine Ins. Co., Phila...	2,000	12.00	24.00	4-11-09
Globe and Rutgers Insurance Co.	1,000	12.00	12.00	11- 3-09
The Hamilton Insurance Co.	1,000	12.00	12.00	11- 3-09
New York Fire Insurance Co.............	1,000	12.00	12.00	4-11-09
North River Insurance Co. of New York..	2,000	12.00	24.00	4-11-09
New Brunswick Fire Insurance Co........	2,000	12.00	24.00	4-11-09
Dutchess Insurance Co.......	2,000	12.00	24.00	4-11-09
DORMITORY.				
Fireman's Insurance Co. of Newark	1,000	13.50	13.50	10- 9-08
Girard Fire & Marine of Phila..........	1,000	13.50	13.50	10- 9-08
Globe & Rutgers Insurance Co. of N. Y...	1,000	13.50	13.50	10- 9-08
North River of New York	1,000	13.50	13.50	10- 9-08
New Hampshire Fire Insurance Co.......	1,000	13.50	13.50	10- 9-08
CATTLE BARN.				
London and Lancashire Fire Insurance Co.	5,600	22.50	126.00	9-13-07
POULTRY HOUSE.				
Dutchess Insurance Co.	1,000	15.00	15.00	10- 9-08
Anchor Fire Ins. of Cincinnati	500	15.00	7.50	10- 9-08
Girard Fire & Marine of Phila............	1,000	15.00	15.00	10- 9-08
SHEEP BARN.				
London & Lancashire Fire Insurance Co...	2,400	22.50	54.00	9-13-07
HORSE BARN.				
London & Lancashire Fire Ins. Co........	2,550	12.887	32.86	6- 7-07
Union Assurance Society	2,550	12.887	32.86	6- 7-07
PRESIDENT'S RESIDENCE.				
London & Lancashire Fire Ins. Co.	1,500	12.887	19.33	6- 7-07
Union Assurance Society	1,500	12.887	19.33	6- 7-07

COMPANY	Amt.	Rate	Prem.	Expires
MAIN BUILDING. DIRECTOR'S RESIDENCE.				
Westchester Fire of New York	1,500	15.00	22.50	1-22-09
London & Lancashire Fire Ins. Co.	650	12.887	8.38	6- 7-07
Union Assurance Society	650	12.887	8.38	6- 7-07
AGRONOMIST'S RESIDENCE.				
Dutchess Insurance Co.	400	11.00	4.40	10-13-08
London & Lancashire Fire Ins. Co.	400	12.887	5.15	6- 7-07
Union Assurance Society	400	12.887	5.15	6- 7-07
THREE LABORERS' COTTAGES.				
London & Lancashire Fire Ins. Co.......	600	12.887	7.73	6- 7-07
Union Assurance Society	600	12.887	7.73	6- 7-07
PIGGERY.				
Nassau Fire Insurance Co. of Brooklyn...	1,000	15.00	15.00	10-13-08
RESIDENCES ON SOUTHERN EXPERIMENT STATION.				
Home Fire of Utah	500	35.00	21.00	1- 1-07
Home Fire of Utah	1,500	13.666	20.50	5- 1-07

INSURANCE RECAPITULATION.

	Total Insurance.	Total Premium.
Main building	$131,000.00	$1,653.65
Mechanic Arts Building	15,000.00	180.00
Dormitory	5,000.00	67.50
Cattle Barn	5,600.00	126.00
Poultry House	2,500.00	37.50
Sheep Barn	2,400.00	54.00
Horse Barn	5,100.00	65.72
Piggery	1,000.00	15.00
President's Residence	3,000.00	38.66
Director's Residence	2,800.00	39.26
Agronomist's Residence	1,200.00	14.70
Three Laborers' Residences	1,200.00	15.46
Residences on Southern Experiment Station	2,100.00	41.50
Total	$177,900.00	$2,348.95

Biennial Report of the Secretary

FOR TWENTY-THREE MONTHS

From Jan. 1, 1905 to Nov. 30, 1906.

Logan, Utah, Dec. 19, 1906.

To the Board of Trustees of the Agricultural College of Utah.

LADIES AND GENTLEMEN:—The Secretary respectfully submits his biennial report of the receipts and expenditures of the College during twenty-three months from Jan. 1, 1905 to Nov. 30, 1906, with an inventory of the property under each fund.

Respectfully submitted,

J. A. BEXELL,
Secretary.

REPORT OF THE SECRETARY

For Twenty-three Months, Ending Nov. 30, 1906.

I. THE COLLEGE.

(State and Morrill Funds.)

Receipts—

Balance with treasurer Dec. 31, 1904		$ 16,690.44
Cash on hand Dec. 31, 1904		103.47
From Federal Government (Morrill fund, 1890)		50,000.00
From state treasurer:		
On appropriation		119,524.45
General maintenance	$103,651.62	
General equipment	5,372.83	
Improvement and repairs	10,500.00	

Interest on land grant		15,399.12
Miscellaneous		18,641.80
Fees	9,549.44	
Sales	8,810.04	
Dormitory Rental	282.32	
Bookstore sales		8,487.47
Mechanic arts restoration		7,600.32
Insurance	7,100.00	
Sales and donations	500.32	
Total		$236,447.07

Expenditures—

General maintenance			$159,045.96
Salaries		$105,795.29	
From Gov't fund	47,888.77		
From State fund	57,906.52		
Janitorial labor (Station 150.00)		3,368.29	
Office labor		493.50	
General and departmental labor		6,604.20	
Supplies		17,271.67	
Fuel (Station 478.00)		5,675.83	
Insurance		964.95	
Light and power (Station 590.10)		3,167.07	
Telephone and Telegraph		504.27	
Postage and stationery		1,298.04	
Bulletins		3,576.29	
General printing		1,533.04	
Advertising		3,032.06	
Experiment Station printing .		349.51	
Repairs		2,279.06	
Traveling expenses		966.30	
Water tax		293.21	
Unclassified		1,873.38	
General equipment			17,991.73
Furniture		4,507.81	
Machinery and implements ...		5,739.32	
Scientific apparatus		2,651.41	
Books, maps, etc.		1,719.07	
Live Stock		835.95	
Unclassified		2,538.17	

Buildings and repairs		11,236.95
Addition to green house	2,801.18	
Main building	2,683.59	
Residences	702.69	
Campus and water works	332.67	
Shops and barns	1,968.52	
Light, heat and power plant..	566.96	
Station buildings	714.40	
Unclassified	1,466.94	
Mechanic arts restoration		39,821.57
Building	22,900.11	
Equipment	16,921.46	
Bookstore merchandise		6,965.55
Balance		1,385.31
Balance with treasurer (government and state funds)..	459.70	
Revolving fund with treasurer	500.00	
Cash on hand	425.61	
Total		$236,447.07

II. FARMERS' INSTITUTES.

Receipts—

From State appropriation	$2,799.53	
Overdraft (due from State)	275.60	
Total		$3,075.13

Expenditures—

Overdraft Dec. 31, 1904	$ 82.13	
Traveling expenses	1,367.43	
Printing	969.00	
Supplies and incidental expenses	615.32	
Equipment	41.25	
Total		$3,075.13

III. THE ARID FARMS.

Receipts—

From state appropriation	$13,060.11
From farm sales	356.34

From San Juan county refund	3.25—	$13,419.70
Overdraft (due from State)		494.97
Total		$13,914.67

Expenditures—

Overdraft, Dec. 31, 1904	479.30	
Salaries	3,301.17	
Labor	6,750.80	
Publications	319.79	
Postage and stationery	236.53	
Chemical supplies	587.14	
Seeds, plants and sundry supplies...	440.31	
Photography	32.40	
Tools, implements and machinery ..	588.24	
Scientific apparatus	63.69	
Traveling expenses	706.97	
Buildings and repairs	55.58	
Freight and express	207.10	
Contingent expenses	145.65	
Total		$13,914.67

IV. IRRIGATION AND DRAINAGE INVESTIGATIONS.

Receipts—

From State appropriation	$10,000.00	
From U. S. government for investigation	1,475.00	
From U. S. government for sugar beet investigation	615.32	
From C. F. Brown, refund for government bills paid by us	91.15	
Total		$12,181 47

Expenditures—

Salaries	5,769.70
Labor	3,200.87
Publications	60.92
Postage and stationery	163.24
Chemical supplies	117.89
Seeds, plants and sundry supplies...	398.81

Fertilizers (water tax)	5.00	
Photography	59.63	
Tools, implements and machinery ...	37.10	
Scientific apparatus	268.41	
Traveling expenses	912.94	
Flumes, weirs, etc	543.72	
Freight and express	31.32	
Contingent expenses	91.00	
Balance	520.92	
Total		$12,181.47

V. SOUTHERN UTAH EXPERIMENT FARM.

Receipts—		
From state appropriation	5,442.80	
From sales	25.10	
From State Board of Horticulture..	8.70	
Total		$5,476.60

Expenditures—		
Salaries	$2,897.50	
Labor	1,460.70	
Postage and stationery	129.89	
Chemical supplies	14.12	
Seeds, plants and sundry supplies ..	322.00	
Fertilizers (water tax)	14.00	
Feed stuffs (for teams)	129.15	
Tools, implements and machinery...	65.75	
Scientific apparatus	36.69	
Traveling expenses	294.45	
Buildings and repairs	21.35	
Photography	8.20	
Freight and express	17.05	
Contingent expenses	30.90	
Balance, including revolving fund, $25.00	34.85	
Total		$5,476.60

VI. CENTRAL UTAH EXPERIMENT STATION.

Receipts—		
From state appropriation	$7,357.56	
From sales	14.50—	$7,372.06
Overdraft on Treasurer (due from State)	116.85	
Less revolving fund	25.00—	91.85
Total		$7,463.91

Expenditures—		
Salaries ....$	2,116.20	
Labor	2,545.94	
Postage and stationery	100.70	
Chemical supplies	96.66	
Seeds, plants and sundry supplies ...	705.40	
Fertilizers (water tax)	65.73	
Feed stuffs	120.10	
Tools, implements and machinery ...	720.06	
Scientific apparatus	78.58	
Traveling expenses	241.45	
Buildings and repairs	53.14	
Photography	6.10	
Freight and express	18.20	
Contingent expenses (including house rent, team and revolving fund).	595.65	
Total		$7,463.91

VII. EXPERIMENT STATION.

(Hatch and Adams Funds.)

Receipts—		
Balance on hand Dec. 31, 1904		$ 654.51
Received from appropriation		36,750.00
Hatch fund ....$	30,000.00	
Adams fund	6,750.00	
Miscellaneous		4,357.30
Total		$41,761.81

Expenditures—		
Salaries	$13,955.32	
Labor	7,978.82	
Publications	526.23	
Postage and stationery	878.04	
Freight and express	99.17	
Heat, light and water	82.97	
Chemical supplies	1,196.30	
Seeds, plants and sundry supplies	1,074.88	
Fertilizers (including water tax)	293.04	
Feed stuffs	2,245.93	
Library	1,559.23	
Tools, implements and machinery	633.04	
Furniture and fixtures	874.54	
Scientific apparatus	2,016.14	
Live Stock	1,635.18	
Contingent expenses	267.50	
Traveling expenses	1,281.80	
Buildings and repairs	817.36	
Balance	4,346.32	
Total		$41,761.81

VIII. RECAPITULATION.

Summary of Receipts.		
I. College	$236,447.07	
II. Farmers' Institutes	2,799.53	
III. The Arid Farms	13,419.70	
IV. Irrigation and Drainage Investigations	12,181.47	
V. Southern Utah Experiment Farm	5,476.60	
VI. Central Utah Experiment Station	7,372.06	
VII. Experiment Station	41,761.81	
Total		$319,458.24

Summary of Expenditures.	
I. College	$235,061.76
II. Farmers' Institutes	3,075.13
III. The Arid Farms	13,914.67

IV.	Irrigation and Drainage Investigations	11,660.55	
V.	Southern Utah Experiment Farm	5,441.75	
VI.	Central Utah Experiment Station	7,463.91	
VII.	Experiment Station	37,415.49	
	Net balance with treasurer	5,424.98	
	Total		$319,458.24

IX. TREASURER'S REPORT.

Herewith find statement of balances in various funds in my hands as treasurer of the Agricultural College of Utah at the close of business November 24, 1906:

College balance		4,349.60	
Gov't fund balance....	$17,277.98		
State fund overdraft, including farmers' inst.	12,878.48		
Experiment station		8,943.65	
Hatch balance	2,708.57		
Adams balance	3,153.78		
Miscellaneous balance..	3,081.30		
Irrigation and Drainage Investigations balance		1,013.42	
Southern Utah Experiment Farm...		33.80	14,340.47
Arid Farm Fund Overdrawn		748.87	
Central Utah Experiment Station...		115.75	
Overdrawn			864.62
Net balance			$13,475.85

Yours truly,
ALLAN M. FLEMING,
Treasurer.

X. PROOFS.

I. The College:

The farmers' institute fund is included in the treasurer's report on the State fund.

Balance as per report, State fund $1,109.71		
Overdraft farmers' institute fund	275.60—	1,385.31
Add outstanding warrants..		14,597.86
		$15,707.57
Less amount deposited since statement		10,432.36
		$ 5,275.21
Less cash on hand and revolving fund		925.61
Balance as per Treasurer's report		$ 4,349.60

III. The Arid Farms:

Overdraft as per report ....$	494.97
Less outstanding warrants	511.22
Balance ....$	16.25..
Less amount deposited since statement ..	765.12
Overdraft as per Treasurer's report .....$	748.87

IV. Irrigation and Drainage Fund:

Balance as per report ....$	520.92
Add outstanding warrants.............	492.50
Balance as per Treasurer's report ......$	1,013.42

V. Southern Utah Experiment Farm:

Balance as per report	$ 34.85
Add outstanding warrants	301.45
	$ 336.30
Less amount deposited since statement..	277.50
	$ 58.80
Less revolving fund in hands of J. T. Atkin	25.00
Balance as per Treasurer's report......	$ 33.80

VI. Central Utah Experiment Station:

Overdraft as per report	$ 91.85
Less outstanding warrants	350.83
	$ 258.98
Less amount deposited since statement...	349.73
	$ 90.73
Add revolving fund in hands of O. Larson	25.00
Overdraft as per Treasurer's report	115.75

VII. Experiment Station:

Balance as per report	$ 4,346.32
Outstanding warrants	4,842.97
	$9,189.29
Less amount deposited since statement...	245.64
Balance as per Treasurer's report	$ 8,943.65

XI. INVENTORY, NOVEMBER 30, 1906.*

I. The College:

Land, 116 acres at $200 per acre		$ 23,200.00
Buildings, (including fixed equipment, waterworks, sewerage system and heating plant)		295,663.99
Administration	$ 1,621.65	
President's office ....$ 1,082.00		

*Not including supplies and Land Grant.

Secretary's office ....$	356.40		
Registrar's office	183.25		
Departments of Instruction ..		63,175.56	
Agronomy	1,149.47		
Animal industry. .$2,515.65			
Dairy ....2,691.65—	5,207.30**		
Art	361.55		
Chemistry	4,900.05		
Commerce	2,371.70		
Domestic Science and Arts.	3,214.15		
Engineering and Mechanic Arts	31,219.92		
English	150.00		
Geology and Mineralogy ..	694.50		
History and Civics	49.50		
Horticulture and botany....	2,350.50		
Mathematics and Astronomy	561.00		
Military Science	29.12		
Modern Languages	21.30		
Music	2,544.00		
Physics	1,486.51		
Physical Education	1,529.70		
Veterinary Science	950.81		
Zoology and Entomology ..	4,384.48		
Miscellaneous Equipment		20,998.03	
Assembly Rooms, Halls and Society Rooms	4,363.80		
Library (including books and periodicals)	14,262.86		
Bookstore Equipment	312.60		
Janitorial	51.05		
Construction and repairs ...	1,005.35		
Dormitory	1,002.37		
Total College Equipment			$ 85,795.24
II. Experiment Station:			
Offices		$ 1,851.40	
Departments		13,283.88	
Poultry ....$	1,680.60		
Irrigation	2,212.42		
Chemistry	4,246.01		
Horticulture	396.85		
Animal Industry	930.50		
Agronomy	3,138.00		
Dairy	438.50		
Unclassified	241.00		
Total Station Equipment			$ 15,135.28
III. Arid Farms, Buildings and Equipment			1,380.05
IV. Farmers' Institute Equipment			569.75
V. Southern Utah Experiment Farm Buildings and Equipment			10,199.30
VI. Central Utah Experiment Station Equipment			1,276.78
VII. Bookstore Merchandise			1,722.18
Grand total			$434,942.57

**Sale of cattle, $1,026.73.

XII. AUDITOR'S REPORT.

We, the undersigned, duly appointed Auditors, do hereby certify that we have examined the books of the Agricultural College of Utah for the twenty-three months beginning January 1, 1905, and ending November 30, 1906; that we have found the same well kept and classified; that they agree in all respects with the Secretary's Report, and that proper vouchers for all expenditures are on file and have been examined by us and found correct.

L. A. Ostien,
E. R. Owen,
Auditors.

Dec. 20, 1906.

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SIXTEENTH ANNUAL REPORT

OF THE

AGRICULTURAL COLLEGE

OF UTAH

— Agricultural

EXPERIMENT STATION

FOR

THE FISCAL YEAR ENDING

JUNE 30, 1905.

LOGAN, UTAH.

Press of
SKELTON PUBLISHING CO.
Salt Lake City.

THE AGRICULTURAL EXPERIMENT STATION OF UTAH

The Bulletins will be sent free to anv address in the State, on written application to the Experiment Station, Logan, Utah.

LETTER OF TRANSMITTAL

To His Excellency,
JOHN C. CUTLER,
Governor of the State of Utah.

Sir: I have the honor to present herewith the Sixteenth Annual Report of the Agricultural Experiment Station of Utah, for the fiscal year ending June 30, 1905, and due February 1, 1906. This report is made in accordance with an Act of Congress approved March 2, establishing Experiment Stations.

Respectfully Yours,

W. S. McCornick,
President Board of Trustees.

June, 1906.

SIXTEENTH ANNUAL REPORT.

REPORT OF THE DIRECTORS.

As the preparation of the Sixteenth Annual Report was not commenced until some time after the close of the fiscal year which it reports, viz., July 1, 1904, to June 30, 1905, it happens that the Director's report has to be written by the successor of the one who held that position during the year reported. Partly because of this circumstance and mainly because of the manifold other duties requiring immediate attention, the preparation of this report was delayed nearly a year beyond the end of the year reported. As a consequence the Station activities for the year are reported rather briefly, and the discussion of plans for the succeeding year are for the most part omitted.

For the personnel of the *Station Staff* as it was at the end of the fiscal year 1904-5, the reader is referred to the inside of the front cover of this report. This list indicates changes from the list as it stood at the close of the preceding year as follows:

Professor James Dryden, Poultry Manager and Meteorologist, who has been connected with the institution since 1892, resigned in August, 1904, to accept a similar position with the Montana Agricultural College and Experiment Station. His efficient service in bringing the experimental work in Poultry to a high degree of efficiency, his success as official photographer, and his adaptability for usefulness in otherwise promoting the general welfare of the Station and College make his resignation felt as a great loss to the institution.

No successor to Professor Dryden had been appointed by the end of the year.

Professor W. N. Hutt came to the institution as Horticulturist in September, 1902, and for the two years he was with us did very creditable work. In October, 1904, he resigned to accept a position as Horticulturist at the Maryland Experiment Station. Mr. Robert S. Northrop was appointed his successor and entered upon his duties in November, 1904. Professor Northrop is a graduate of the Michigan Agricultural College. From 1901 to 1903 he held the position of Assistant Professor of Agriculture and Forestry in the Agricul-

tural College of North Dakota, and during the year 1903-4, that of Instructor in Horticulture in Cornell University.

Mr. William M. Jardine, who assisted in the Agronomy Department since April, 1903, resigned in the spring of 1905 to become manager of the extensive arid farming operations of the Utah Arid Farm Company. Mr. J. B. Nelson, who for several years has been farm foreman, was advanced to the position of assistant Agronomist to succeed Mr. Jardine.

Mr. Joseph E. Greaves, a graduate of this College, class of 1904, was appointed Assistant Chemist in the Station and entered upon his duties at the beginning of this fiscal year.

Equipment.—During the winter and spring of 1905 the State Legislature made provisions to greatly extend the possibilities of this Station for usefulness. The Southern Experiment Farm, located near St. George, which for six years had been operated by the State Board of Horticulture, was made a branch station and its management lodged with the officials of this Experiment Station. Provision was also made for the establishment of an additional sub-station to be known as the Central Utah Experiment Station, and to be located in one of the four counties, Weber, Davis, Salt Lake, or Utah. The county in which this Farm is to be located is to furnish the land, not less than sixty acres, and a good water right to one second-foot continuous flow through the irrigating season. The selection of the site from among those offered by the several counties was left with a commission consisting of the State Board of Land Commissioners, the Board of Trustees of the Agricultural College and the Director of the Experiment Station. The location has not by the close of this fiscal year been decided upon. For work and improvements on the Central Experiment Farm during two years, the sum of eight thousand dollars was appropriated and for that on the Southern Experiment Farm, the sum of six thousand dollars.

Provision was made by this legislature to carry on more extensive experimentation in irrigation and drainage. The sum of ten thousand dollars was appropriated on condition that the United States Department of Agriculture appropriate an equal sum to carry on, in co-operation with the Utah Experiment Station, investigations in Utah along the lines of the best use of water in the irrigation of various crops, and the amelioration by drainage of land that has become water-logged, or overcharged with alkali through irrigation.

The addition of these two farms to the Experiment Station as

permanent sub-stations and the provision for this irrigation and drainage work will enable the station to do much more extensive investigational work, and especially will make it possible to fit the work more nearly to the climatic and soil conditions and especial local interests of the different farming or horticultural regions of the state. While the conditions in the several localities are not so far different but that in most lines of work the conclusions arrived at from experiments in one locality are directly applicable to the others, yet there are lines of work that are more dependent upon local conditions, and it is such lines that will be followed primarily at these sub-stations. Horticultural crops in general are more dependent upon local conditions than most field crops or than animal industry work, therefore horticultural investigations will doubtless predominate in the experimental work at these two sub-stations. The southern Experiment Farm already has about half its area set out in trees and vines and these are for the most part in very thrifty condition, either in bearing or soon to come into bearing. A good Foreman's cottage, two laborer's cottages and a good barn are on the Farm.

Lines of Work.—The following lines of work were continued from previous years without much change, viz., irrigation investigations, dry farming, alkali land reclamation work, soil survey work, sugar-beet seed improvement, stock feeding experiments, and codling moth and other insect pest invetigations. Of these the irrigation and the dry farm work were the most extensive. In co-operation with the Irrigation and Drainage Investigations of the Office of Experiment Stations, United States Department of Agriculture, the irrigation investigations at Greenville were carried on along lines as heretofore, to determine the best use of water for not only yield of crops but also quality as shown by chemical analysis, and in some cases by cooking tests.

The experiments in irrigation were extended also to a number of other localities in the State, using one or more crops in each locality. These localities were near Garland in Box Elder County, Tooele in Tooele County, Hinckley in Millard County, Richfield in Sevier County, Nephi in Juab County, Big Cottonwood in Salt Lake County, and Provo, Utah County. In each of these localities a uniform area was platted off into 6 to 12 plats and different amounts of water were applied during the season to the different plats, thus in the main duplicating on a larger scale the work done at Logan during the last few years.

In this co-operative irrigation and drainage work various locali-

ties were also examined with reference to the needs of drainage, preliminary to commencing actual operations in drainage experiments.

The crops put on the Alkali Farm near Salt Lake were only a partial success. Some spots of the farm still showed considerable alkali, and all of it showed a tendency to bake hard, due apparently to the puddled condition of a soil which is naturally high in clay. Crops were again put out in the fall of 1904 and the spring of 1905, and fairly good stands of spring grains and alfalfa are secured, but the fall grain and some hoe crops are not doing so well.

On one of the dry farms, the Juab County arid farm, an attempt was made at growing fruit trees, but before the season was far advanced rabbits damaged the trees to such an extent that it is necessary to replant to give it a fair trial. Otherwise the dry farm work is along the lines previously mapped out.

On the Southern Experiment Farm, besides continuing the tests of varieties of peaches, prunes, grapes, apricots, plums, figs, quince and apples, previously started, some additional garden crops were tried and experiments started in the use of cover crops in orchards. A soil survey of this farm was started in the summer of 1905.

Publications.—"The Relation of Smelter Smoke to Utah Agriculture" is discussed by J. A. Widtsoe in Bulletin 88, issued at the opening of this year.

Bulletin 89 on "A New Centrifugal Soil Elutriator," by P. A. Yoder, was prepared during the previous year and published early in this year.

In Bulletin 90, entitled "Feeding Beet Molasses and Pulp to Sheep and Steers," L. A. Merrill and R. W. Clark gave a brief resume of results already reported by this and other experiment stations on feeding sugar-beet by-products to stock and then report and discuss the results of feeding these products to steers and sheep here in the years 1902 and 1903.

Bulletin 91, by J. A. Widtsoe and L. A. Merrill on "Arid Farming in Utah," gives a general discussion of arid farming, the action of the Legislature in providing for the establishment of experimental arid farms, and the opening work on these farms.

Bulletin 92 on "Poultry Experiments" by James Dryden, gives the results of experiments in poultry along several lines, and gives a discussion of these results at this station for the several past years.

The work for Bulletin 93, Agricultural Reconnaissance of the

"Uintah Indian Reservation," was practically completed during the year, but it was not published.

The plans for the experimental work on the six arid farm substations for the season of 1905 were outlined in Circular No. 3, and those for irrigation at the Greenville Farm and the vegetation house in Circular No. 4.

Reported by

P. A. YODER,

Director.

June, 1906.

DEPARTMENT OF AGRONOMY.

To the Director:—

The work of the Agronomy Department for the year ending June 30, 1905, has been confined largely to the problems outlined in the report of this Department for the year ending June 30, 1904, the main energies of the Department being devoted to the solving of the following problems.

The best use of water for irrigation and its effect upon plant growth.

The growing of crops without irrigation.

Sugar-beet seed production.

Variety testing.

Reclamation of alkali lands.

The best use of water and its effect upon plant growth.—In this work the object has been to follow as closely as possible the plan of the preceding year in order that sufficient information may be secured on this question before any conclusions are drawn, in this way making the results more authentic and consequently more valuable. Most of the work under irrigation has been under way for three years and in some instances longer. As a result of these experiments some very valuable information has been collected and some will be ready for publication within a short time.

The Growing of Crops Without Irrigation.—This work has been continued with the exception of a few variations that have been made from time to time as certain problems outlined in 1903 seemed to have to be solved. The results thus far obtained have been most satisfactory and are certain to aid in the future development of Utah Agriculture. Bulletin No. 91 has been published. From this publication can be seen the extent to which this line of investigation is being carried on.

Sugar-Beet Seed Investigation.—This line of work was begun

at the Station in 1903. The first roots grown from home grown seed were set out this year. All the mother beets set out tested 18 per cent sugar or above. The seed produced possessed high germinating powers and it is hoped that their prepotency will be as good. Results cannot be expected without long continued work, and, therefore, it will be some time before any diffinite conclusions can be arrived at.

Variety Testing.—The work under this heading has been confined largely to sugar-beets. Sixteen different varieties are being tried out and from the experiments some interesting data are being collected for publication. In addition to the work in sugar-beets a few varieties of oats and a number of varieties of corn are being tested. The work with corn is comparatively new in Utah, but very promising.

The Reclamation of Alkali Lands.—The work done on the Alkali farm located a few miles west of Salt Lake City has not, in all instances, been satisfactory.

The land, after continually being worked, is found to be practically without life. Its physical texture is very poor; its humus limited, and consequently it is very difficult to grow crops upon the land. Most of the land was seeded to alfalfa this year and the stand secured, while thin, will likely make good, and in time will produce a good crop of hay. A few plats were seeded to wheat, oats and other miscellaneous crops, most of them germinated but few grew to maturity. The question of alkali is no longer the important one in the experiment. The physical condition of the soil must be improved before crops can be successfully grown.

Vegetation House Experiments.—This work is outlined in the report for this Department for 1903-4, no changes being made for this year.

Respectfully submitted,

W. M. JARDINE,

Agronomist.

June, 1906.

THE DEPARTMENT OF ANIMAL INDUSTRY.

To the Director:—

The work of the Department of Animal Industry during the year closing June 30, 1905, was along lines previously laid out. A flock of sheep has been maintained in order to ascertain the profit that may be derived by keeping sheep on valuable irrigated farms.

The results secured last year were more than had been expected. This line of work will continue for a couple of years more, at the end of which time the results will be brought together for publication.

In swine feeding the work has been confined to the cost of production and a comparison of sugar-beets and sugar-beet pulp. In connection with ascertaining the value of growing lucern for swine, a study is being made of the grazing qualities and hardihood of pure-bred Tamworths, Yorkshires, Poland Chinas, and of the various grades.

The work in feeding cattle has been largely confined to ascertaining the cost of production and making a comparison of sugar beets and sugar-beet pulp as food for dairy cows. Considerable experimental work has been carried on in feeding different amounts of grain with alfalfa hay to dairy cows. The idea is to find out how much grain should be fed with the alfalfa.

A yearly record of the performance of a herd of nearly all pure-bred Jerseys in the state is being collected. This is a well bred herd and is well cared for.

The idea is to ascertain the improvements that will gradually take place through the introduction of better blood and care, and to show in time what a farmer may do to improve his herd.

During the winter, in co-operation with Lars Hansen, a practical feeder, the Department carried on experiments in feeding sugar-beet pulp to work horses at the Logan Sugar Factory. No evil results were noted. The horses took the pulp better the forepart of the winter than later. Ten to thirty pounds per animal per day were fed.

In the creamery considerable experimental work has been done in butter and cheese making in the use of separators, and a bulletin on the same is now ready for publication.

Respectfully submitted,

R. W. Clark,

February, 1906. Animal Husbandman.

DEPARTMENT OF HORTICULTURE.

To the Director:—

I herewith submit a breif report of the work done in the Horticultural Department for the year ending June 30,, 1905.

Considering the fact that my connection with the Experiment Station began after the work for the first half of this fiscal year

was closed, I have considerable difficulty in making a satisfactory report. This is due principally to the fact that the records are incomplete and thus do not show fully just what the experiments were intended to show. In the fall of 1904, the variety test of onions which had been carried on during the growing season, was finished for the year. The results showed such a variability of the varieties of the vegetable that it seemed wise to repeat the experiment until more positive results were obtained. It was evident from the results of that year's test that Prizetaker was one of the best yielders and of good size, shape, color, and quality, while Southport White Globe was a fairly good producer and of very fine quality. And, in fact,, is to be recommended strongly for planting in a home garden or for general market. The Yellow Globe Danvers stands close behind the Prizetaker as a general market onion. It is a good yielder, of satisfactory shape, size and color, and in some markets is the favorite.

At Brigham City, in 1904, tests were made of watermelons, canteloupes and tomatoes. This work was done partly in connection with the Department of Agriculture at Washington. The notes were evidently all sent to the Department so that I cannot report upon the results obtained.

During the fall of this fiscal year the first season's work at Greenville to determine the duty of water on cabbage, onions and carrots, was finished and the second test was started in the spring following. As yet the data at hand is not conclusive enough to justfy a statement of results obtained. However, after the results of the whole season's work are at hand it can be safely and accurately determined whether or not it is advisable to report upon the work.

Pear blight, which has become a very serious pest in Utah, together with a number of other orchard problems, were given considerable study in the orchard at the College. So far the studies have not resulted in any advantage to the fruit growers, but it is confidently hoped that good may result in the future.

Respectfully submitted,

ROBT. S. NORTHROP,

June 1906 Horticulturist

DEPARTMENT OF CHEMISTRY.

During the summer of 1904 the Chemical Staff was increased by the engagement of Mr. J. E. Greaves as Assistant Chemist. During-

ing the summers of 1904 and 1905 Mr. J. C. Thomas was employed at soil work. The college work was further expanded so that the time of the associate chemist was almost completely taken away from the Station work.

The work of the Department continued, for the main part, along the same line as during the last year. The irrigation work in co-operation with the Departments of Agronomy, Irrigation and Horticulture, continued, as also did the work in sugar-beet seed development. A large number of soil samples had accumulated and more were collected during this year. The mechanical and the chemical analyses of these were pushed forward during the year. The physical analyses was made of soil samples collected from Cache and Sanpete Counties in a soil survey of these counties made prior to 1898. These samples were described with reference to their chemical composition in Bulletin 52. Following the action of the Legislature transferring the control of the Southern Utah Experiment Farm to this Station a detailed soil survey was made of that Farm during the early part of the summer of 1905. In connection with a reconnaissance of the Uintah county, by the Irrigation Department, a number of soil samples were brought in for alkali determinations, mechanical analysis and the determination of some other physical properties.

Some systematic work in incubation by regulating the supply of carbon dioxide and moisture to the incubators, was planned by this department and carried out in co-operation with the Poultry Foreman. This work promises to yield some interesting and practical results, but it has not progressed far enough yet to draw conclusions.

Reported by,
P. A. YODER,
Chemist.

June, 1906.

DEPARTMENT OF IRRIGATION ENGINEERING.

To the Director:—

I submit the following report of work undertaken by the Irrigation and Drainage Department for the year ending June 30, 1905.

The State Legislature of 1904-5 made a special appropriation for irrigation and drainage work in this State, to be conducted in co-operation with the Office of Experiment Stations of the United

States Department of Agriculture. This bill provided for the conducting of experiments and demonstrations on the proper use of irrigation water and the reclamation of alkali and water-logged lands. The experiments and demonstrations provided for included the investigation of the water requirements of crops ordinarily grown in Utah, the right time of applying the water, the best manner of its application, irrigation requirements of the soils and subsoils of Utah, the relation of irrigation to the accumulation of alkali, and further investigation of methods best suited for redeeming the alkali and water-logged lands of the state, together with such other investigations as would have in view economical use of irrigation water and the redeeming of now useless alkali lands. The bill further provided that the work shall be planned and executed jointly by the Utah Experiment Station and the Office of Experiment Stations of the Department of Agriculture. Ten thousand dollars was appropriated for carrying out the provisions of this act, provided the United States Department of Agriculture appropriate a like sum, thus making $20,000. available for the work during the years 1905 and 1906.

During the early spring of 1905 plans were prepared and provisions made whereby $6,000 was to be used in irrigation investigations and $4,000 to be used for drainage investigations for each of the two years. Irrigation experiments were conducted at Logan, Garland, Tooele, Hinckley, Richfield, Nephi, Big Cottonwood, Provo, Brigham City and Manti. Drainage surveys were made at Huntington, St. George and Logan. The tile drain at Hyde Park was extended to include about ten acres additional to that already drained. The irrigation work at Logan was carried out in accordance with the outline given in Circular No. 4 and in other localities mentioned, experiments were conducted for the purpose of ascertaining the adaptability of our experimental results under conditions as found in Cache County to conditions as found in other parts of the State. The Department further undertook the study of methods of canal management as practiced in different sections of the State and for this purpose circular letters were sent out to several irrigation companies. In the fall of 1904 the writer made a brief agricultural reconnaissance of the lands of the Uintah Indian Reservation and the results were published in Bulletin No. 93 of this Station.

The drainage investigations have been under the charge of Professor C. G. Elliott of the Department of Agriculture, and the irri-

gation investigations have been under the direction of the Irrigation Department of the Utah Experiment Station, but in both instances the plans were prepared jointly.

The field work in irrigation was conducted by Mr. Charles F. Brown and Mr. E. R. Morgan and the drainage field work was conducted by Professor C. G. Elliott and myself. The results of the year's work in irrigation and drainage will be reported in a bulletin to be issued on that subject.

Respectfully submitted,
WALTER W. McLAUGHLIN,
Irrigation Engineer.

June, 1906.

POULTRY DEPARTMENT.

During the fiscal year ending June 30, 1905, the Station Staff was without a specialist in poultry management and as a consequence but little systematic experimental work was done in this line. Egg records of the laying hens continued to be kept and the breeding up of strains for high egg production was continued. The Poultry Foreman took part in experimental work in incubation which was conducted by the Chemical Department and is mentioned in the report of that department. The preparation of a bulletin on "Poultry Experiments" was finished by the former Poultry Manager, Professor Dryden, in absentia and was published as Bulletin No. 92. This records the results of experiments and studies with poultry during the last few years.

Reported by,
P. A. YODER, Director
For the Poultry Manager.

June, 1906.

DEPARTMENT OF ENTOMOLOGY.

To the Director:—

The work of the Entomological Department for the year ending June 30, 1905, has continued along the general lines of the previous years with the addition of two new pests taken up at the beginning of this season.

Codling Moth Work.—This insect continues to be by far the worst pest of the fruit-grower in the arid regions, and, in spite of the immense amount of study that has been expended upon methods of destroying it, many points still remain obscure or unknown. The success of the experiment with two early sprays the previous

season suggested the possibility of making a thorough test of the relative value of early and late sprays and to determine, if possible, just how, when, and where each spray killed the worms.

To determine the value of any given spray it is necessary to determine its actual killing power on each brood of worms separately. To ascertain this it was necessary to accurately separate the damage done by the first brood from that of the second. This had, I believe, never been done. It was tried in the experiments in Colorado by using mosquito netting tents, but without success. Professor Cordley in Oregon came near it, but his methods did not give accurate results. By studying the results of last season's work, as represented in the life history chart, it was determined that there would be a period of a few days between the broods in which it would be possible to examine the apples on the trees and separate those that were, or had been, infested with worms of the first brood from those in which the few earliest worms of the second brood were just entering.

Two orchards were secured for the tests, one belonging to Hon. Thomas Smart and the other to Mr. Hoggan. Both orchards were extremely wormy the previous season and both were located so that they were subject to serious outside infestations, thus presenting about the worst possible conditions to be found in the state.

One orchard was sprayed twice early, except for the trees in the experiment and the other orchard was left unsprayed, except for the trees tested. Considering the conditions of the orchards the results were most gratifying and showed conclusively the importance of the early sprays as compared with the lates ones alone.

Strawberry Insects—The Leaf Roller is doing serious injury the strawberry industry of Weber and Boxelder counties and is slowly spreading to adjoining districts. A test of the value of spraying before the crop came on was undertaken on Mr. W. O. Knudsen's place at Brigham City and promised to give valuable results when the entire crop was destroyed by hail.

The Crown-Girdler was also discovered in one field in Brigham City where it had killed quite a number of plants. This is its first appearance in Utah, so far as the writer is aware, and steps should be taken to prevent its spread to other districts at least, and if possible, to stamp it out entirely.

Sugar-Beet Insects.—The past season has been the worst that the sugar-beet raisers have had to encounter in years. To begin with

the season was very promising, but soon changed to an exceptionally hot and dry summer with water scarce in many valleys. Then a number of new insect pests appeared, and several old ones did considerable damage before they were brought under control. Taken all together the loss was fully one-third of the crop and of the loss probably one-half was due to insect depredations.

The Beet Leaf-hopper (*Eutettix tenella*).—This is a small pale leaf-hopper which has been commonly called the "White Fly" by the beet-growers. The term white fly has, however, been used for a group of much smaller insects, none of which occur in injurious numbers in Utah, and so this pest should be known as the Beet Leaf-hopper. It occurred in large numbers in the fields of Sevier County and so damaged the beets early in the season that one-third of the acreage was plowed up and then more than half of the rest did not amount to very much. These leaf-hoppers did considerable damage in every district, but in most of the other districts there was either a shortage of water or some other pests to complicate matters, while in Sevier County the water was ample and no other pest was observed in injurious numbers.

The injury from this pest does not seem to be due so much to the amount of sap that is actually sucked out—for the leaf-hoppers all suck sap through a sharp beak—as to the fact that its punctures seem to cause a sort of thickening of the veins of the leaf and an unhealthy condition called "Curly Leaf" or "Blight." It would hardly be safe to state that this condition was due entirely to the attack of the leaf-hopper as other insects and the hot weather may have weakened the beets so that they yielded more readily than they otherwise would. This insect, however, belongs to a group of leaf hoppers, many of which cause similar appearances on other plants, and one especially which causes the leaves of the pig weed to become "curly" and red, and often stunts the plant. In the case of the pig weed the injury is also out of all proportion to the number of leaf-hoppers at work, sometimes a badly curled plant will only have one or two young hoppers.

The Beet Army Worm and *Beet Web Worm* were also injurious in several localities, one field at Wellsville being stripped bare in one or two days after thinning. Several tests of spraying with Paris Green were made and this proved satisfactory where taken in time.

The False Chinch Bug was unusually abundant this season and where pepper grass or tumble-weeds were allowed to grow along the

ditches the young bugs often migrated on to the beets. They have a habit of clustering on one beet at a time and sucking on that until it wilts down and dies, and then going to another. Later in the season they often attack mother beets and ruin the seed stalks.

Several other species of leaf-hoppers were also present in unusual numbers, and, while they did not seem to do any particularly noticeable injury, their work no doubt contributed to the loss.

The Flea Beetles were not as injurious as usual in many sections of the State. For several years past, however, they have so seriously injured many fields that they had to be replanted. Their chief injury is just at the time the beet is coming out of the ground, when they will often destroy a field in a few hours. This injury will no doubt continue until the farmers learn to destroy the wild mustard, mint and other plants that grow alongside the field and furnish breeding ground to carry these pests over from one year to another.

Miscellaneous Work.—The collection of injurious insects has been substantially increased in number and value. Several cases showing the life history and work of the principle sugar-beet insects, corn insects, etc., have been completed and are now on exhibition. During the year a number of lectures have been delivered at farmers' institutes and other gatherings, several articles have been written for the agricultural press and a large amount of correspondence attended to. Some time was spent in making arrangements for a preliminary meeting to organize a State Horticultural Society, and an address was prepared for delivery at this meeting and at the North West Fruit Growers' Association at Boise.

The codling moth investigations have brought good results and are awakening much interest throughout the State. Many problems still await solution and other results need confirmation from the warmer sections of the State. The sugar-beet interests are seriously threatened by the recent outbreak of beet pests, and the more serious problems in this connection should be taken up the coming season. Other lines now in course of investigation will be continued.

In order to carry on experiments in different lines the Department needs more breeding cages and more equipment for spraying. To satisfactorily arrange the accumulation of notes and correspondence requires more office equipment in the form of files, etc.

With the rapid development of the fruit industry and the in-

crease in injurious insects on other crops the work of this Department is rapidly increasing in value to the state, and, in order to do justice to these new demands, the amount of time allowed this Department for Station work should be materially increased.

I take pleasure in acknowledging my indebtedness to my Assistant, Mr. E. G. Peterson. In the codling moth studies, especially, his assistance has been most valuable and will be recognized in joint authorship of the results.

Respectfully submitted,
E. D. BALL,
Entomologist.

January, 1906.

FINANCIAL STATEMENT

UTAH AGRICULTURAL EXPERIMENT STATION

In account with the United States Appropriation, 1904-5.

DR.

To receipts from the Treasurer of the United States as per appropriation from fiscal year ended June 30, 1905, as per act of Congress approved March 2, 1887 .... $15,000.00

CR.

By	Salaries	$7,394.05	
	Labor	3,537.27	
	Publications	133.39	
	Postage and Stationery	431.90	
	Freight and Express	47.02	
	Heat, Light, Water and Power		
	Chemical Supplies	527.95	
	Seeds, Plants and Sundry Supplies	537.36	
	Fertilizers	105.00	
	Feeding Stuffs	1,032.02	
	Library	21.51	
	Tools, Implements and Machinery	101.22	
	Furniture and fixtures	92.85	
	Scientific Apparatus	264.63	
	Live Stock	46.55	
	Traveling Expenses	494.21	
	Contingent Expenses	19.95	
	Buildings and Repairs	213.12	
	Total	$15,000.00—	$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Utah Agricultural Experiment Station for the fiscal year ended June 30, 1905; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving nothing.

And we further certify that the expenditures have been solely for

the purpose set forth in the act of Congress March 2, 1887.

Signed
JOHN T. CAINE, JR.
WILLIAM PETERSON
Auditors.

Attest:
J. A. BEXELL, Custodian.

I, J. A. Bexell, Secetary of the Board of Trustees of the Agricultural College of Utah, do hereby certify that John T. Cain, Jr., and William Peterson were duly appointed to audit the accounts of the Utah Agricultural Experiment Station for the year ending June 30, 1905.

J. A. BEXELL, Secetary.

FINANCIAL STATEMENT FOR THE ARID FARM FUND, 1903.

Receipts.

From the State		$12,500.00
From Sales		170.79
		$12,670.79

DISBURSEMENTS.

Salaries	$ 1,161.33	
Labor	2,402.04	
Publications		
Postage and Stationery	99.80	
Chemical Supplies	156.45	
Seeds, Plants and Sundry Supplies	284.11	
Photography	59.34	
Tools, Implements and Machinery	1,028.13	
Scientific Apparatus	24.00	
Contingent Expenses	43.00	
Traveling Expenses	753.45	
Buildings and Repairs	27.68	
Freight and Express		
	$ 6,071.49	

SUPPLEMENTARY REPORT

Dr.

To receipts from other sources than the United States for the year Ended June 30, 1905.

Balance on hand July 1, 1904		$ 79.16
Received from the sale of farm products		1,156.27
		$1,635.43

Cr.

By Salaries	$ 18.86	
Labor	453.08	
Publications		
Postage and Stationery	16.70	
Freight and Express	.60	
Heat, Light, Water and Power	37.50	
Chemical Supplies	42.50	
Seeds, Plants and Sundry Supplies	76.82	
Fertilizers	6.25	
Feeding Stuffs	133.80	
Library	.69	

Tools, Implements and Machinery	89.72	
Furniture and Fixtures	72.25	
Scientific Apparatus	30.05	
Traveling Expenses	83.15	
Contingent Expenses	178.00	
Live Stock		
Buildings and Repairs	16.98	
Balance June 30, 1905	378.48	
Total	$1,635.43	$1,635.43

List of Bulletins and Circulars Issued by the Utah Experiment Station up to June 30, 1905.

Those Marked * are out of print, June, 1906.

*No. 1 General statement of purposes, work in progess and to be entered upon, with plans of barn and Station building.
*No. 2 Plow Trials.
*No. 3 Experiment with Garden Vegetables.
*No. 4 Dynamometer Tests with Wagons, First Annual Report
No. 5 Potato Trials.
No. 6 Trials of Sleds and Tillage Tools.
*No. 7 Draft of Moving Machines.
No. 8 Ensilage.
*No. 9 Time of Watering Horses.
*No. 10 Strawberries and Garden Vegetables.
*No. 11 Influence of Shelter on Food Consumption.
No. 12 Horticultue.
*No. 13 Feeding Horses Hay and Grain Mixed.
*No. 14 Horticulture.
*No. 15 Soiling Steers—Green vs. Dry Food.
No. 16 The Disgestibility of Green and Dry Timothy.
*No. 17 Feeding Root Crops vs. Dry Feed.
*No. 18 Notes on Forest and Fruit Trees.
*No. 19 Feeding Ensilage vs. Dry Food.
*No. 20 Horticulture.
*No. 21 1—Feeding Ruminants on Grain Alone; 2—Night vs. Day Irrigation.
*No. 22 1—Grass vs. Non-Grass Fed Pigs; 2—Exercise vs. Non-Exercise of Pigs; 3—Value of Natural Water for Crop Growth.
*No. 23 1—Shelter of Stock; 2—Exercise vs. Non-Exercise of Stock; 3—Early vs. Late Irrigation.
*No. 24 Irrigation.
*No. 25 Fruits, and Forest, Shade and Ornamental Trees.
*No. 26 Sub-Irigation vs. Surface Irrigation; Water for Irrigation.
*No. 27 Irrigation: Early, Late and Useful.
*No. 28 The Value of Grass in the Production of Pork; Exercise vs. Non-Exercise of Pigs.
*No. 29 Irrigation: Amount of Water to Use; Relative Feeding Value of Timothy, Lucern and Wild Hay.
*No. 30 Narrow vs. Wide Nutritive Rations for Horses.
*No. 31 Time to Harvest Lucern; Mulching.
*No. 32 Roots and Plants of Farm Crops.
*No. 33 1—Grazing Value of Variety of Grass; 2—Drilling vs. Broadcasting Grass Seed.
*No. 34 Relative Value of Corn and Oats for horses.
*No. 35 Steer Feeding.
*No. 36 Relative value of Wheat, Peas, Corn and Barley in the production of Pork.
o. 37 Fruit and Fruit Trees.

*No. 38 Preliminary Report on Seepage Water and the Underflow of Rivers.
*No. 39 Farm Irrigation, Orchard Irrigation.
*No. 40 Th Value of Grass and its Relation to Exercise in the Production of Pork.
*No. 41 Tuberculosis.
*No. 42 Creaming Experimens.
*No. 43 1—Dairy Herd Record, 1894-5; 2—Winter Feeding Experiments with Dairy Cows; 3—Some Suggestions on the Building and Equipment of Factories.
*No. 44 Alfalfa or Lucern; Its Feeding Value.
*No. 45 Vegetables and Fruits.
*No. 46 Earthen Dams.
*No. 47 The Climate of Utah.
*No. 48 Alfalfa or Lucern; Its Chemical Life History.
*No. 49 Spraying.
*No. 50 The Water Supply of Cache Valley.
*No. 51 Poultry Experiments; Egg Production.
No. 52 The Chemical Composition of Utah Soils; Cache and Sanpete Counties.
No. 53 Utah Sugar-Beets, 1897; Co-operative Experiments.
*No. 54 Cattle Feeding; 1—Comparison of Utah Feeding Stuffs; 2—Digestion Experiments with Shredded Corn-fodder, Lucern Timothy and Wheat-Bran.
*No. 55 Orchard Pests. Insects; Fungous Diseases; Sprays and Spraying.
No. 56 Field Experiments with Wheat, Oats and Barley; 1—Variety Tests; 2—Miscellaneous Tests.
*No. 57 By-Products of the Dairy; (a) Experiments in Pig Feeding; (b) Experiments in Calf Feeding.
*No. 58 The Chemical Life History of Lucern.
No. 5'. Utah Sugar-Beets for 1898.
*No. 60 Poultry Experiments.
*No. 61 Alfalfa or Lucern; Its Feeding Value; The Cutting Time.,
*No. 62 Tree Planting in Utah.
*No. 63 Sugar-Beets in Sanpete and Sevier Counties.
*No. 64 1—The Codling Moth; 2—A Wasp that Destroys the Apple Worm; 3—Sour Cherries; 4—The Oregon Evergreen Blackberry.
No. 65 Plant Diseases and Insect Pests; San Jose Scale.
*No. 66 Corn Experiments.
*No. 67 Poultry Experiments.
*No. 68 Experiments with Dairy Cows.
*No. 69 The Golden Vine Pea.
No. 70 Pork Production in Utah.
No. 71 Carying Capacities of Irrigation Canals.
No. 72 A Soil Survey of Salt Lake Valley, Utah.
*No. 73 Experiments in Butter and Cheese Making.
*No. 74 Lead Ore in Sugar-Beet Pulp.
*No. 75 Arid and Dry Farming.
*No. 76 Forcing Lettuce.
*No. 77 Horse Feeding.
*No. 78 Lamb Feeding Experiments.
*No. 79 Process Butter.
*No. 80 Irrigation Investigations in 1901.
*No. 81 Poison in Water from a Gold and Silver Mill.
*No. 82 Feeding Beet Pulp to Steers and Sheep.
*No. 83 Pruning of Tree and Bush Fruits.
*No. 84 The Grain Smuts,
*No. 85 Pear Blight.
*No. 86 The Right Way to Irrigate.
*No. 87 The Codling Moth.

No. 88 The Relation of Smelter Smoke to Utah Agriculture.
*No. 89 A New Centrifugal Soil Elutriator.
*No. 90 Beet Molasses and Beet Pulp Feeding with Sheep and Steers.
No. 91 Arid Faming in Utah.
*No. 92 Poultry Experiments.

CIRCULARS.

No. 1 Memoranda of Plans for Arid Farm Investigations in 1904.
No. 2 Memoranda of Plans for Irrigation Investigations in 1904.
No. 3 Memoranda of Plans for Arid Farm Investigations in 1905.
No. 4 Memoranda of Plans for Irrigation Investigations in 1905.

In addition to the above publications, an annual report has been issued each year.

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BULLETINS.

Bulletin 88—The Relation of Smelter Smoke to Utah Agriculture.

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The District Investigated.
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The Substances Emitted by the Smelters.
The Effect of the Smelter Smoke upon the Soils.
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Bulletin 89—A New Centrifugal Soil Elutriator.

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The Regulating Valve.
The Centrifuge.
Adoption of Grades of Soil Particles.
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Bulletin 90—Feeding Beet Molasses and Pulp to Sheep and Steers.

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Bulletin 91—Arid Farming in Utah.

Half-Tone Engravings.
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The Assistance of Counties.
Reasons for Believing Arid Farming Feasible in Utah,—The Amounts of Water Required for Plants,—The Rainfall of the State,—Other

Climatic Conditions,—The Soil Conditions,—The Real Problems of Arid Farming in Utah.

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The Work Yet to be Done,—The Work of this Year must be Repeated, —A greater Variety of Crops must be Tested,—Cultural Tests,—Quality of Crops Grown.

The Principles of Arid Farming,—Plowing,—Fallowing,—Selection of Seed and Seeding,—Havesting.

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Growing Ducklings.
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CIRCULARS.

Circular No. 3.—Memoranda of Plans for Arid Farm Investigations.

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General Instructions.
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San Juan County Arid Farm.
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Tooele County Arid Farm.
Washington County Arid Farm.
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Circular No. 4—Memoranda of plans for Irrigation Investigations.

Instructions and Regulations,—General,—The Spring Work,—General Field Notes for all Crops,—Grasses,—Additional Field Notes for the Cereals (Wheat, Oats, Barley, etc.),—Additional Field Notes for Corn and Allied Crops,—Additional Field Notes for Roots. (Potatoes, Sugar-Beets, etc.),—Harvesting,—The Measurement and Application of the Water,—The Taking of Soil Samples,—Sampling for Chemical Development,—Miscellaneous.
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Vegetation House.

13

SEVENTEENTH ANNUAL REPORT

OF THE

AGRICULTURAL COLLEGE

OF UTAH

EXPERIMENT STATION

FOR

THE FISCAL YEAR ENDING

JUNE 30, 1906

LOGAN, UTAH

Press of
TRIBUNE-REPORTER PRINTING CO.
Salt Lake City

The Agricultural Experiment Station of Utah

EXPERIMENT STATION STAFF.

W. J. KERR,
President of the College.

P. A. YODER...................................Director and Chemist
E. D. BALL...Entomologist
R. W. CLARK.....................................Animan Husbandman
W. W. McLAUGHLIN...............................Irrigation Engineer
R. S. NORTHROP.......................................Horticulturist
W. M. JARDINE..Agronomist
H. J. FREDERICK.......................................Veterinarian
J. WILLARD BOLTE.......................................Poultryman
J. A. CROCKETT...................................Assistant Dairyman
ROBERT STEWART...................................Assistant Chemist
J. E. GREAVES....................................Assistant Chemist
E. G. PETERSON.................................Assistant Entomologist
C. W. PORTER...Photographer
JOHN STEPHENS..................................Assistant Agronomist
J. T. ATKIN......................Foreman Southern Experiment Farm
OLA LARSON.......................Foreman Central Experiment Farm

The Bulletins will be sent free to any address in the State, on written application to the Experiment Station, Logan, Utah.

LETTER OF TRANSMITTAL.

To His Excellency,
JOHN C. CUTLER,
Governor of the State of Utah.

Sir: I have the honor to present herewith the Seventeenth annual Report of the Agricultural Experiment Station of Utah, for the fiscal year ending June 30, 1906, and due February 1, 1907. This report is made in accordance with an Act of Congress approved March 2, establishing Experiment Stations.

Respectfully Yours,
W. S. McCORNICK,
President Board of Trustees.

REPORT OF THE DIRECTOR.

In this, the Seventeenth Annual Report of the Agricultural Experiment Station of Utah, a brief outline is given of the conditions and the activities of the Station during the fiscal year ending June 30, 1906, including the plans and general needs for the future as now determined or foreseen. A general discussion is presented in this section, the Director's Report. More detailed discussions of the several fields will be found in the sections which follow, i. e., the reports of the heads of departments, the outlines of bulletins published, the financial statements, etc.

Station Staff.

At the opening of this year the Directorship and the position of Chemist of the Experiment Station were assigned to Professor P. A. Yoder, who for the preceding four years was connected with the Station, during the first year as Assistant Chemist and later as Associate Chemist. The former incumbent, Professor J. A. Widtsoe, held the position of Director and Chemist during the preceding five years. Previous to his appointment as Director he had for six years held the position of Chemist.

Professor W. M. Jardine was at the opening of this year elected Agronomist to succeed Professor L. A. Merrill. Professor Jardine is a graduate of this College, Class of 1904. During his senior year and most of the year after graduation, he assisted in the Department of Agronomy. In the spring of 1905, he severed his connection with the College and Station to accept the position as Manager of the farming operations of the Utah Arid Farming Company. Professor Merrill was connected with the Department of Agronomy since 1896, and was head of the department since 1901.

Professor W. W. McLaughlin resumed his connection with this Station on November 1, 1905, as Irrigation Engineer, re-

turning from the Montana field whither he had been temporarily assigned as an Irrigation Engineer of the Irrigation and Drainage Investigations of the United States Department of Agriculture.

At the opening of this year, the position of Veterinarian was created, and filled by the election of Dr. H. J. Frederick of this place, who was engaged by the College and Station on half time. Dr. Frederick is a graduate of the Brigham Young College of Logan, and later attended the Agricultural College during the first two years of its establishment. During the years 1902-5, he attended the Iowa State College, taking the degree of D. V. M., in 1905. He entered upon his duties as Veterinarian July, 1906.

Mr. J. Willard Bolte of Lakeside, Illinois, a graduate of the Michigan Agricultural College, Class of 1905, was elected to the position as Poultryman, which position had been vacant for a year after the resignation of Professor Dryden. He entered upon his duties here on September 1, 1906.

On February 28, 1906, Assistant Agronomist J. B. Nelson severed his connections with the Station to accept a similar but more remunerative position at the Montana Experiment Station. He was succeeded by Mr. John Stephens of Malad, Idaho, a 1905 graduate of the short agricultural course of this institution.

Besides the departments already established at this Station, there is great need for specialists along several other lines. Among these may be mentioned a dairyman, a bacteriologist, a plant pathologist, a soil physicist, and a mechanician. It is not advisable, however, to increase the number of departments to such an extent as to make it impossible to support well the departments established.

The personnel of the Station Staff as it stood at the close of this fiscal year is given on the inside of the title page of this report, and consisted of eight heads of departments and six assistants. Besides these there were also employed four salaried foremen at the Home Station and one each at the Southern and Central substations, also a variable number of temporary assistants and helpers. The time of all heads of departments was divided between College and Station work, and in one case, as noted above, between College, Station and private work. One of the six assistants was employed by the Station on full time.

The proportion of the time of the heads of departments allowed for Station work averaged about half, and that of the assistants whose time was divided averaged about one-third. Several of the assistants have part of their time occupied as students. In the case of heads of departments it will be necessary from time to time to readjust the division of the time between College and Station, as the work of either expands, or as additional assistants are provided for. It may not be feasible yet for some time with the heads of departments to separate completely the Station work from the College work. It would be highly desirable, however, to reduce his College work to a minimum, or even to assign it altogether to other instructors, in those departments in which the Station work has sufficiently expanded, and in which the one in charge has shown special aptitude for investigation. In the case of the assistants, it is in many cases feasible, and therefore it should be the aim to make them full time Station employees. In nearly all cases where instructorship duties in the College are combined with Station duties, there is the tendency for the College duties to infringe on the Station time, principally because the College duties are per program, and can, therefore, not readily be put off, while at busy periods the Station work is frequently postponed. This also applies where a portion of the assistant's time is devoted to College studies as students. Because of this tendency, and also to enable us to place more dependence in our assistants, I recommend that where possible we employ the assistants on full time in the Station. In most cases these assistants should be college graduates. It is desirable that they be well grounded in the agricultural sciences, yet successful students of pure science should be chosen in preference to unsuccessful students who may have had the agricultural work. One characteristic that is especially needed in Station employees is the spirit of carefulness and absolute reliability. An error in his work, besides affecting the institution itself, may through erroneous published statements damage innumerably many others who make use of the conclusions.

Just at present one of the greatest difficulties in the administration of the Experiment Station work is the securing and retaining of well-qualified specialists as heads of departments and assistants. With the expansion of Experiment Station work in every state of the Union, made possible by the enactment of the

Adams act and with the rapidly increasing work of the Department of Agriculture, there arises a steadily increasing demand for trained research men. In practically every state this results in many changes in the personnel of the Station staffs. In this, what might be termed a scramble for men, the less wealthy stations are at a decided disadvantage. To plan and carry out research work of a fundamental and truly scientific chararter, such as is contemplated by the Federal laws establishing and supporting the stations and as is explicitly required by the Adams Act, we need men who, besides having the foundation afforded by a good college or university course or its equivalent, and by practical experience in farming pursuits, have also had training in scientific research enough to demonstrate their ability to carry on such investigations. It has at times been necessary to place men in charge of departments who lacked this training in research, and to employ as assistants men who were not nearly through their college course. While this Station has been fortunate in such cases in securing very promising young men, yet it has also had the misfortune of having men induced away to other stations by more remunerative offers, after they had been here just long enough to gain such experience as is essential to the most effective work. While this station has probably not been more unfortunate in this respect than many others in the less wealthy states, yet we have evidence in this that it would be wiser economy to advance the salary scale so as to bring the positions here in effective competition with similar positions in the more wealthy states, economizing if necessary by carrying on fewer lines of work. With these facts in view, and recognizing also that the learned professions and expert work in all lines are better paid now than they were a few years ago, the salary scale has been decidedly advanced during the last few years, and should doubtless be advanced yet more.

Equipment.

No extensive new equipment either in buildings or in implements was provided for the home station during this year. A fireproof vault was built in the Station building to store records of experiments, reserve files of bulletins, and other valuable books and papers. Provisions were made for finishing the basement of

this building with cement floor and plastered wall to use as a mailing room, and for storage of publications. The plan also involves the moving of the photographic dark room to the basement and finishing another office room upstairs to be used by the Veterinarian.

Late in the year when the additional Federal Fund became available through the Adams Act, the preparation was made for more thorough-going research work by providing a considerably better equipment of scientific literature for the Station Library, and apparatus for the laboratories.

Of the new apparatus secured, the following more important articles may be mentioned:

Ether extraction apparatus,
Analytical balance,
Steam drying oven,
Gas analysis apparatus,
Colorimeter,
3 platinum dishes,
2 platinum crucibles,
Thermostat with heat regulating device,
Best Zeiss microscope with accessories.

Among the additions to the Station Library, besides a number of single volumes and small sets, there were the following:

American Chemical Journal, completing set from 1879.

Berichte der Deutschen Chemischen Gesellschaft, completing set from 1882.

Berliner Tieraerztliche Wochenschrift, from 1889.

Centralblatt fuer Agricultur Chemie und Rationeller Landwirtschaft from 1897.

Centralblatt fuer Bakteriologie from beginning.

Chemisches Centralblatt from 1897.

Journal of American Chemical Society, completing set from 1899.

Journal of the Chemical Society, London, completing set from 1872.

Journal fuer Landwirtschaft.

Landwirtschaftliche Vesuchsstationen.

Veterinary Journal of London from beginning.

Zeitschrift fuer Analytische Chemie, completing set from beginning.

Starting work on the Central Experiment Farm involved the purchase of an extensive equipment of implements and a first-class team. Some implements previously selected for the Experimental Arid Farms were paid for during this year.

Lines of Work.

Besides the general Station work carried on mainly by the federal appropriations, the Station carried on work under the three special state funds, viz., the Arid Farm fund, the Southern Farm fund and the Central Farm fund, also under the joint State and Federal Irrigation and Drainage Fund. In sugar beet seed improvement work and alfalfa variety tests, we were materially aided by the cooperative arrangements with the Bureau of Plant Industry, and in sugar beet pest investigations by similar arrangements with the Bureau of Entomology.

Experimental Arid Farms.

The six Experimental Arid Farms established by the Legislature four years ago are now producing their third crops. The main thing thus far accomplished is to awaken the people of the State to the possibilities in arid farming. In this respect we believe that the highest expectations of that legislature have been realized. The acreage brought under cultivation as a consequence of these experiment farms, the added wealth brought to the people and the increased receipts brought to the State Treasury, amply justify the expenditures incurred by the State. If the object in the establishment of these farms were merely to determine whether or not arid farming can be made a paying business in these localities, then in most cases the experiment might be considered completed. But that is only one of the objects. What varieties of corps and what methods of handling them are the most profitable, are questions for the answer to which most of the work is being done. Where so many factors are involved in determining results as are in these tests, it requires a number of years to get sufficient data through many repetitions to enable us to draw trustworthy conclusions on all the questions investigated. Along some lines, however, with the three years' data before us, we begin to see some fairly definite indications. A bulletin is now in preparation for publication

giving such results as the limited time at the disposal of those having this work in charge permits them to work out, and at the present stage of the work seems to justify. The work on these farms is for the main part in charge of the Agronomist, and further details regarding it will be found in his report. Besides carrying on work with field crops on the Arid Farms, the possibilities in fruit growing are being tested on the Juab County Farm by the Horticultural Department.

Southern Experimental Farm.

On the Southern Experiment Farm, variety vests in horticultural crops were made with those varieties which had previously been set out, and with a number of additional varieties. Some work was started in studying the value of cover crops in orchards. The general supervision of this farm, the planning of crop experiments, and the reporting of the results of these experiments are under the immediate supervision of the Horticulturist, who is preparing a detailed report for publication.

Analytical work on a soil survey which was started by the Chemical Department during the preceding year, was carried on this year, but not to completion.

Central Experimental Farm.

In the work of locating the **Central Experiment Farm**, the soil conditions on several of the proposed sites were carefully examined and a number of analyses made. Finally a site located between Lehi and American Fork, in Utah County, was selected for this farm, but as this selection was not accomplished until too late to do work on it in the fall, the work of preparing experimental plats and setting out trees for orchard experiments was rushed in the spring. Unfortunately for this work the spring opened unusually late, and labor was scarce and expensive during the brief season available for this work. However, a considerable area was prepared, and trees were set out on part of this. On the lower level near the State Road, some experiments on rotation with field crops were started, also some investigations on pests in sugar beets, and the codling moth in the orchard. As the best use of irrigation water is an important question in the profitable utilization of the lands of which this farm is represent-

ative, and as irrigation as applied to orchards has not been extensively investigated, it was decided to make experiments in irrigation of orchards a prominent feature on this farm. The Irrigation Engineer in cooperation with the Horticulturist planned some experiments along this line and the ground was in part made ready for this work. As most of the work on this Farm is to be along horticultural lines, the general supervision of all the work was placed under the Horticulturist. He, assisted by the Irrigation Engineer and the Agronomist, is to prepare a detailed report on this Farm.

Irrigation and Drainage Investigations.

In Irrigation and Drainage, under the cooperative agreement with the Irrigation and Drainage Investigations of the United States Department of Agriculture, extensive investigations on the best use of water were carried on at the home station, and at a number of localities in various parts of the state, and several additional drainage experiments were installed or arranged for to determine the best means and probable cost of reclaiming or improving water-logged and alkali land. In the irrigation work we do not rest content with studying the yield in its relation to the amounts and seasonal distribution of water applied and the methods of application, but we investigate also the quality of the crops as shown by the chemical analysis, milling tests, cooking tests, etc. The unusual heavy rains during the spring and early summer of 1906, which proved such a boon to farming interests generally, seriously interfered with our irrigation experiments, as we could not have any plats with a minimum of water to compare with the others. For the season of 1906 some changes were made in the work at Greenville, principally in using more of the plats for answering questions regarding the best seasonal distribution of a given amount of water. The work for the season was planned jointly by the Agronomist, the Irrigation Engineer, the Horticulturist, and the Chemists, and the carrying out of the field work was placed in charge principally of the Agro-omy and the Horticultural Departments, the Irrigation Engineering Department having in charge the measurement and application of the water. An immense amount of data have accumulated

in this work during the last three or four years which requires a great amount of time to prepare for publication. Much work was done by assistants during the year in bringing together and tabulating, ready for study, these data. With the special effort made, this tabulation has now been brought practically up to date. The departments cooperating in this work will study the data to draw conclusions and report in bulletins. It is hoped that part of the results can be got ready for publication soon. Much of this cannot be published at once either because of a lack of sufficient data to draw safe conclusions, or because of a lack of time of those in charge to prepare them. From time to time as additional features are worked up and experiments completed, bulletins will be published.

Work Under Federal Funds.

In the work carried under the regular federal funds of the Station, all departments participated. The work of the Animal Husbandry, Poultry, Veterinary, and Entomological Departments, was wholly supported by these funds.

In the Animal Husbandry Department, effective work was done in methods of feeding and the care of stock, and in improving the general conditions for the herd of cattle.

The Poultry work was extended by getting a larger amount of breeding and feeding stock. A number of experiments were carried on in feeding and management of stock, and some in incubation.

During this year time and means were placed at the disposal of the Entomologist for much more extensive experimental work than in previous years. During the spring and summer he was almost completely relieved of college duties to devote his time to investigations on sugar beet pests and to continue work on the codling moth and some other pests. A cooperative arrangement with the Bureau of Entomology was entered into to investigate the sugar beet pests.

Besides the work on the Southern and Central Experiment Farms and the Irrigation work in which the Horticultural Department engaged under other funds, this department carried on some variety testing of onions and had supervision of the orchard at the Home Station.

The Agronomy Department was mainly occupied with work under the Arid Farm fund, and the Irrigation and Drainage fund. This department also took part in several lines of work in cooperation with bureaus of the United States Department of Agriculture, viz., sugar beet seed improvement, and alfalfa testing in cooperatin with the Bureau of Plant Industry, and cropping the tract used in the alkali reclamation in cooperation with the Bureau of Soils. For the discussion of other lines of work and for more details regarding these, the reader is referred to the report of the Agronomist.

The Department of Veterinary Science, which was established this year, commenced a study of the prevalence of tuberculosis in cattle and rendered some service in looking after the health of the station animals. The need of this department has long been felt in the Station, and while only one-fourth of the Veterinarian's time was allowed for Station work this year, it is hoped that the work will expand and that much light may be thrown on the nature of diseases troubling the stock of this region, and means of combating them.

The Chemical Department joined with nearly all departments of the Station and under all the funds. Its main work which was in connection with the Irrigation and Arid Farming Investigations, and the soil survey work, has already been mentioned under these headings. Other important cooperative lines of work were in sugar beet seed improvement and in poultry feeding.

The Adams Fund.

On March 16, 1906, Congress enacted the Adams law by the term of which the appropriation from the Federal Government to the Experiment Station of each of the states and territories is increased by five thousand dollars during the first year that this law is in operation, and during each of the succeeding five years an additional increase of two thousand dollars is made, thus ultimately doubling the Federal appropriation to the stations, making it thirty thousand dollars instead of fifteen thousand dollars as heretofore. The administration of this fund on the part of the Federal Government is placed in charge of the Secretary of Agriculture, who is represented in the work by the Office of Experiment Stations. The law requires that this new fund shall

be used for investigations along agricultural lines, and that none of it is available for administrative expenses or for printing of bulletins and reports. The Office of Experiment Stations immediately upon the passage of the bill reported that fact to the Director of the Station, and gave it as the interpretation of the Department of Agriculture that the first $5,000.00 of this fund is available during the year ending June 30, 1906. It was also requested by the Office of Experiment Stations that plans of work to be undertaken under the Adams fund be submitted for the approval of that Office. About a month after the passage of the bill, however, a notice was received stating that the Comptroller of the Currency declared the first installment under the Adams fund not available until after June 30, 1906, during the fiscal year 1906-7. The work planned and purchases proposed for the balance of the year ending June 30, 1906, were therefore dropped for that year. On June 30, 1906, the farther communication reached us that Congress passed an amendment to the Adams Bill interpreting the bill to make the first installment of $5000.00 available for the year ending June 30, 1906, and that it could be used for work done or debts contracted prior to July 1, 1906, even though goods ordered are not delivered until later. In this Station the work done after the passage of this bill and the bills of goods ordered and chargeable to this fund when finally settled, fell somewhat short of the full amount available. The Secretary's itemized statement of the receipts and expenditures of this fund, as also that of the other funds of the Station, are included on the last few pages of this report. There was no time left to carry on extensive investigations under this fund during this year. Realizing the need of better library and laboratory equipment for carrying on work of a fundamental character as required under this law, it was decided to use most of the Adams fund available during this year for the purchase of reference books, sets of scientific periodicals and scientific apparatus. Plans were formulated and ultimately approved by the Office of Experiment Stations for research work under this fund in four of the departments of the Station.

Below is a quotation from a letter from Secretary Wilson of the Department of Agriculture to the Station Directors.

"The increased liberality of the Federal Government in providing for the endowment of research and experimentation in

agriculture should be a further incentive to the States and local communities to supplement these funds for the extension of demonstration experiments, farmers' institutes, agricultural colleges, schools, and courses of instruction, and the general education of the rural communities along industrial lines, in order that the masses of our farmers may be so educated from early youth that they will appreciate the benefits of original research and experimentation as applied to agricultural problems, and be able to appropriate in the most effective manner for their own benefit and the general welfare of the Nation whatever practical results are obtained from the work of the agricultural experiment stations."

As noted before the terms of the Adams Bill do not permit of its being used for general maintenance or printing bulletins and reports. No large proportion of any of the Federal Funds can be used for buildings and repairs. This makes it highly important that the State make provision for such additional buildings and improvements as are necessary to carrying on the increased amount of investigations made possible by this Act of Congress. With but few exceptions the buildings now available are in excellent condition and afford adequate means for the immediate future to carry on the experimental work. There is, however, urgent need of an additional incubator cellar in the poultry plant, a silo for experiments in the utilization of corn fodder and other forage, feeding sheds for cattle and sheep, an isolation hospital for veterinary work, and improvements on the cold storage and the cheese curing rooms of the creamery. To afford us more means to publish the results of our investigations, we deem it very desirable also that the State provide a moderate fund for the publication of bulletins.

Bulletins and Reports.

The following bulletins and reports were prepared and issued during this year:—Bulletins, No. 94, Summary of Pig Feeding Experiments from 1890 to 1902, with Deductions from the Same: No. 95, Codling Moth Work in 1904; No. 96, Care of Milk on the Farm and the Manufacture of Butter and Cheese. Press bulletin No. 11, Extermination of Prairie Dogs. Annual Reports Nos. 15 and 16. A summary of their contents will be found in

another part of this report. Much of the preliminary work was done in the preparation of bulletins on the arid farming and the irrigation and drainage investigations.

Mailing List.

During the summer and autumn of 1905, the Station mailing list was revised. It was discovered through inquiries that in a few localities from one-fifth to one-third of the names on our list do not belong there, the persons having died or moved out of the state, or engaged in other business so that they were no longer interested in the bulletins. Cards were therefore sent out with directions that those desiring to continue to receive our publications supply a stamp to the return part, fill in their address, and mark in the list of subjects those in which they are interested. The subjects on the list were Dry Farming, Irrigation Farming, Sugar Beet Growing, Stock Raising, Fruit Growing and Vegetable Gardening, Dairying, and Poultry Raising. There were nearly 8000 of these cards sent out, but only about half of them were returned. For the staffs of other state experiment stations and the investigators of United States Department of Agriculture, the Official Mailing List, furnished by the Office of Experiment Stations, is now being used. The Utah list was made to include also state officials, officers and libraries of farmers' organizations, school libraries, certain classes of school and church officials, and all newspapers within the State. Many new names were put on the list by request. With the lists thus revised, we now have a mailing list of about 4,500 exclusive of the Official List, a reduction of about three thousand below what we had before the revision.

A complete list of **bulletins published** thus far by this Station and an indication of which are still available for distribution among citizens of the state requesting them, will be found in another part of this report.

DEPARTMENT OF AGRONOMY.

To the Director:

In accordance with your request, I submit herewith a brief outline of the work in the Department of Agronomy for the year ending June 30, 1906, also an outline of the proposed work of the Department for the coming year.

The main energies of the Department, with the exception of a few changes, have been directed along the lines previously laid down, viz., irrigation investigations, alkali land reclamation, sugar beet investigations and dry farming. In addition to this work the following new lines of nvestigation have been inaugurated:

Rotation of crop experiments; alfalfa seed investigations, and the growing of corn fodder for forage, together with other miscellaneous experiments of minor importance. Notwithstanding the fact that all of the workers in the Department at the beginning of the year were new men, the work has not suffered any draw-backs, but rather the closing year marks a steady and healthy growth in the Department.

Irrigation. The work in irrigation, as formerly, has been cooperative with the Irrigation Engineering and Chemical Departments. This work has been confined entirely to the Greenville and Fankhauser Farms. The general plan of the work in irrigation was a continuation of the work formerly laid down. The following changes, however, were thought advisable by those concerned; method and time of applying the water, this to be determined by the need of the growing crop, and time of cultivating, this to be determined by the condition of the soil. These changes which were made on a number of experiments, will serve as a check on the experiments as orginally laid down. Some experiments were discontinued as complete and the data are now ready for computation.

Sugar Beet Investigations. The work in sugar beets has been directed along two lines, variety testing with sugar beets, and sugar beet seed investigations. The work along these lines has been carried on in cooperation with the United States Department of Agriculture, Bureau of Plant Industry. While the re-

sults so far obtained in the work with sugar beet seed investigation have not been the most encouraging, yet valuable data are being collected for future use in the development of the sugar beet industry of the State. Investigations along this line move slowly, time being the necessary requisite for authentic results.

Alkali Reclamation. The Alkali Farm four miles west from Salt Lake City, the reclamation of which has been under way for the past four years, is now with the exception of a few acres, all seeded to alfalfa. The harvest this year was most satisfactory and points to the fact that with the exception of a few patches, this forty acre tract can be considered as reclaimed. It is expected that the farm will be ready to turn over to the owner by June 1, 1907.

Dry Farming. This makes the third year in which this work has been receiving special attention from the Station. Two crops have already been harvested and the third crop is now under way. Bulletin 91 of this Station is a report of the first harvest, 1904. The results of 1905 and 1906 will be ready for publication within a short time. The results of 1905 and 1906 are even more encouraging than those recorded in Bulletin 91. The work in dry land agriculture conducted at this Station has been conducive of much good. The question of growing crops in the arid west without irrigation is a most popular one at the present time, and this is no longer considered as impossible or uncertain.

Rotation of Crop Experiments. It has been made possible for the department to extend its experimental work owing to the establishment of the Central Experiment Farm at Lehi, Utah. A six acre tract on the farm was set aside to be used by this Department for work in crop rotation and miscellaneous work. A five year rotation has been started and it is expected that this rotation will be continued for a series of years with the exception of a few changes from year to year, as results might seem to warrant. In this way valuable information can be collected for use by the farmer where extensive farming is being carried on.

Alfalfa Seed Investigation. Very few data are available to-day on this question, and since it has been found impossible to answer satisfactorily the many inquiries coming to this office concerning the growing of alfalfa seed, it was thought advisable to conduct a number of experiments along this line in order to

secure reliable data on this important subject. The work is just begun, one crop only having been harvested. Some most remarkable results have already been obtained that will be of value to the alfalfa seed grower, and it is expected that these data, together with the data of the work of another year or two, will be of inestimable value to the development of this new industry.

The Growing of Corn for Fodder. A five acre tract of land one-half mile north of the College Farm was leased for the purpose of growing corn for fodder. The work was being done in cooperation with the Animal Husbandry Department. The object of the experiment is to find out the amount of fodder that can be grown per acre and the cost of production, also the feeding value of corn fodder for different farm animals. Experiments on its feeding value are to be conducted under the direction of the Animal Husbandry Department. The crop has just been harvested, and while there are not sufficient experimental data at hand to warrant a positive statement concerning its value, the writer does not hestitate to say that the yield this year warrants the growing of fodder in rotation with roots and cereal crops.

Two bulletins in which this department is interested, one on irrigation invesigations, the other on arid farming, are in course of preparation.

The proposed work of the department for the ensuing year beginning July 1, 1906, and ending June 30, 1907, will be about the same as in the past except where certain experiments have been running sufficiently long to warrant their conclusions, in which event new experiments will be inaugurated, also more extended tests will be conducted in connection with alfalfa seed production, seed selection and crop rotation.

In conclusion I should like to urge and emphasize the importance of conducting experiments for the purpose of developing more hardy drouth resistant plants to grow on the dry farms of Utah. So far most of the experiments conducted have been for the purpose of determining whether or not any crop could be grown with profit where irrigation could not be practiced. This question has been determined in the affirmative. The point now is, to find by selection and breeding, a greater variety of hardier crops to grow. Another point, the securing of water for culinary purposes for the dry farmer should be seriously considered. In fact, I believe this question of sufficient importance to demand

legislative action. Money should be appropriated by the State for the purpose of solving this important problem. Unless water is obtained for culinary purposes, we can never expect to see permanent homes made on the dry farms of Utah.

Very respectfully submitted,

W. M. JARDINE,

Agronomist.

DEPARTMENT OF HORTICULTURE.

To the Director:

I herewith respectfully submit a brief report of the activities of the Department of Horticulture for the fiscal year ending June 30, 1906.

During this period the work of the department has been extended over the state to such an extent, by reason of the Southern and Central Utah Experiment Stations having been placed largely under its management, together with some work at the Juab County Arid Farm, that I have been unable to give the best possible attention to any one line of work. This is particularly true during the spring and fall of the year, for then my presence is required to a considerable extent in the class room, yet at those times the experiments which are being started or completed should receive the utmost care. I must, therefore, insist that if the recommendations made in the succeeding pages be even partly followed, assistance must be provided, for I have been unable in the past to give the attention the work warranted, and with my class work much heavier this year than it has been before, it will be even more difficult to give the outside stations such care as the work now in progress demands.

During this fiscal year, the work done under the Hatch fund was much less than desirable, largely on account of the great amount of time required of me elsewhere.

A thorough test of onions and turnips has been carried on for two years. The results of the first test were obtained and the second planting was made during this period. The result now on hand show that the standard varieties, Prize Taker, Yellow Globe

Danvers and Red Wethersfield were the heaviest yielders and the most suitable for market varieties, while the Southport White and Yellow Globe were heavy yielders of best quality, thus making them desirable for home or local market.

Since onion culture is becoming a prominent industry in Utah, the importance of this work is obvious and I desire to call attention to the great need for future work with this crop. It is my wish that certain experiments be conducted to ascertain the most profitable method of growing them. Therefore, I have planned for next year a series of cultural tests, which will require about two belts of the Fankhauser Farm.

I have also during the past year given the subject of pear blight some study. This disease has practically stopped the growing of pears in some sections of the state and has lately been attacking apples with quite serious results. Some varieties particularly are quite susceptible to it and I would like to make a thorough study of the trouble. It is my belief, that data collected as to the severity of it upon different varieties would be of inestimable value to those contemplating the starting of an orchard. Also a careful study of the advisability of pruning under sterile conditions to eradicate it would be valuable.

Considering that there is considerable land in Utah which compares favorably with the land used elsewhere for cranberry culture, I would like to make a thorough test of the adaptability of cranberries to this region.

I would also like to test varieties of early potatoes. This crop is an important one in Utah, but the varieties are few and badly mixed.

Southern Experiment Station.

Durng this period, the activities on the Southern Station were quite similar to those carried on in the past. The funds granted by the Legislature for this biennium were only sufficient for maintenance and a few very inexpensive experiments. In fact, it has been necessary to so reduce labor that only help sufficient to keep the farm in presentable appearence has been employed. We were allowed a small amount of money for the purchase of nursery stock, which was used to procure plants of various species of nuts and fruits which heretofore had not been

grown in that district. It is our hope that these species will be found successful in that locality and if so it will be of great advantage to the farmers, for most of the species under trial are those which have a concentrated product of rather high market value.

In addition to the pecans, walnuts, persimmons, and other new nuts and fruits, a number of new varieties of grapes and small fruits have been placed on trial to be tested in connection with other varieties which have been in use for some years. It is the plan also to use these plantings for some cultural experiments, one of which is now under way. This is a trial of the various methods of pruning and training the grape. So far, but one method has been in use in that country and it is our desire to carry on this work for some years, not only to see if the yield and profit can be improved, but also to see if the quality and the resistance to disease can be bettered.

If sufficient means and assistance to carry on other lines of work are available, I would like to see the following experiments conducted, for if we consider the present condition of the country influenced by the Southern Station, together with the vast possibilities of that section, the importance of work intended to promote the growing of special crops can be comprehended.

I believe that a series of experiments on the growing of early vegetables for the markets of Salt Lake City and some of the mining comps, together with the collection of data as to the best methods of marketing the crops for financial returns, would show, that, in spite of the distance from the railroad, profit could be secured by the farmer if he would grow standard varieties and give them the care received in other sections where the growing of garden truck is a leading industry. Moreover, this work could well be extended to take in the marketing of nuts, grapes and other fruits during the latter part of the year. If by so doing, we could induce the people to give more attention to such products, the benefit financially to that section of Utah would be enormous and far reaching.

It is quite probable also that the growing of Smyrna figs could be made a profitable business, for they always command a high price and could easily withstand the long haul to market. The trees do fairly well in Southern Utah, but do not fruit because they require the presence of a small insect to fertilize them.

This insect will not survive the winter of that locality. This then requires the erection of a small greenhouse, which when heated properly might suffice to keep them over winter in good condition.

Central Experiment Station.

Work was started on the Central Experiment Station during the spring of this fiscal year. The horticultural department was given the responsibility of the work on the farm and a large amount of time was spent by myself in directing matters thereon. Although the farm has been under cultivation for years, the nature of the soil is such that it had become very uneven. This required a large amount of leveling before any planting could be done.

It was the intention to prepare the ground and plant a large number of trees for experimental purposes, but the work required in preparation, was so great in extent, that, but a small amount of planting could be accomplished. We have planted eleven plats of one-half acre each to eleven of the leading commercial varieties of apples. It is expected that the coming spring three more varieties will be added and upon these fourteen plats, similarly planted and cared for, notes will be taken and a thorough comparison of the desirability of the varieties for commercial orchards will be made.

In the nursery are sufficient trees and plants to carry on a duty of water test in cooperation with Irrigation Engineer, also to plant a series of plats for cultural tests such as pruning, spraying, cultivating, etc., and to plant a small orchard of the leading varieties for comparison and study. We also have plants on hand to start a model small fruit plantation and make a comparison of varieties therein.

In regard to new lines of work not previously planned and arranged for on this station, I believe that the study of root diseases on nursery stock is of the greatest importance. These diseases constitute one of the greatest troubles with which the nurseryman and orchardist has to deal, and concerning which he has but very little information. If possible, arrangements should be made to have considerable study given this matter and its relative severity, danger and contagiousness ascertained.

Juab County Arid Farm.

In the spring of 1905, some trees of different species of fruits were planted on this farm to ascertain if they could succeed with no irrigation. They did very well during the summer until the rabbits got to them and ate the tops off. I had a second planting made in the spring of 1906, many of which did not succeed in starting on account of the stock being poor. Those that did start came out well and made a good growth during the season. It is my desire that I have sufficient funds allowed to enable me to replace those dead and care for the remainder for a few years, until we can determine whether or not they will produce fruit.

Irrigation.

In this branch of the station work, my department has been endeavoring to grow onions, carrots, cabbage and celery to ascertain the duty of water. The results are not satisfactory, though the method of work is probably the best that can be adopted. It seems evident from the results this year that the soil is in poor condition from lack of humus and manure.

I also believe that much of our poor success with onions is due to the manner of irrigating. It seems evident from the check plats that flooding is not the proper method though it does not appear to make as much difference with carrots.

It is also evident from the work this summer that further work in leveling the plats must be done if best results are to be obtained.

Respectfully submitted,
R. S. NORTHROP.

DEPARTMENT OF ANIMAL INDUSTRY.

To the Director:—

The work done during the fiscal year closing June 30, 1906, was along lines previously laid out. The main work the last few years in feeding has been with sugar beets and by-products of the sugar beet factory. Considerable material on this work has accumulated and will be ready for publication in the near future.

During the year an experiment was carried out to ascertain the value of sugar beets as a beef and mutton producer. Experiments covering the year were made on cost of producing pork and best type of hog for grazing. With milch cows, various amounts of grain were fed with alfalfa and grass hay. The object of this work is to learn how much grain should be fed for must economical production.

Maintenance work with swine, cattle and sheep has been continued. Owing to the incompleted condition of the cattle barn experiments in calf feeding had to be discontinued.

The condition of the herd is improving. During this year it was made possible for the Department to institute more stringent measures for the eradication or control of tuberculosis. A few of the less valuable animals were killed and the remaining purebred animals which were affected were put under stricter quarantine. At this writing only four animals are affected and a large number of unaffected young cattle from tuberculous cows are on hand. The Bang system in eradicating this disease has proved efficient, one of the draw backs in this particular piece of work being irresponsible labor.

As to the requirements of the Department, the most pressing are the completion of the cattle barn and more pasture land with more water to the acre. Experiments have been impaired on account of these unfavorable conditions.

The work of the Department has suffered in the past on account of the difficulty of securing help competent to conduct experiments in feeding work, and this matter should receive consideration.

Respectfully submitted,

R. W. CLARK,

Animal Husbandman.

POULTRY DEPARTMENT.

To the Director:

I hereby respectfully submit my report for the Poultry Department during the past year:

The Poultry Department during the year 1904 and 1905 was without a head, and very little was done in the way of experimental work. Mr. John Hopkins, the foreman in charge, labored under considerable difficulty as he had little or no assistance, and the stock and apparatus was in exceptionally good condition, under the circumstances, when I took charge of the Department September, 1905. There was sufficient stock on hand to fill most of our 32 breeding and experimental pens in the new building, and what was not on hand was purchased so that by December 1, 1905, the entire building was equipped with exceptionally well bred fowls in most cases, and we had 27 pens of laying fowls under experimental conditions at that time. These included representatives of the following breeds: Rose-comb Brown Leghorns; Single-comb White Leghorns; White Plymouth Rocks; Barred Plymouth Rocks, and White Wyandottes.

A large number of experiments were undertaken, the most important question under investigation being feeding and management for fertility of eggs and for economy of production. Several breeding experiments were taken up. Tests of three kinds of houses are at present under way, and a large number of rations and methods of feeding are being compared at present. In addition to these experiments, I completed a series of experiments with raising chicks for breeding stock and for market, the conditions observed involving incubation, brooding, and feeding. These are now already for publication.

The additions to the plant have been in the form of stock and general apparatus. Two very fine males of the White Wyandotte and White Plymouth Rock varieties were secured, and are at present in our best breeding pens. Eggs of Indian Runner ducks and Mammoth Bronze turkeys were secured and incubated, and aside from the mature stock, which came through the winter exceptionally well, there were, at the time of my leaving Logan, some eight or nine hundred head of young stock coming

on to replace the old stock. I believe, as the Department stood at that date it was in good shape, regarding both buildings and live stock, to undertake the numerous problems confronting it.

A considerable sum has been expended on fencing and interior apparatus, such as trap nests, partitions, broody coops, fountains, leg-bands, etc.

The experiment in egg production will be ready to report on sometime after the first of December, 1906, and will give material for quite an extensive bulletin.

Respectfully submitted,

J. WILLARD BOLTE.

DEPARTMENT OF VETERINARY SCIENCE.

To the Director:

The work of this Department has been principally in animal diseases. An investigation is being carried on to ascertain the prevalence of tuberculosis in cattle. Quite a number of herds have been tested and others are being tested by the tuberculin test. On post mortem examinations of animals reacting to this test, the diagnosis was invariably confirmed. Diseased organs or parts of organs were found, in all cases examined, showing the tests one to be relied upon where properly applied. There is no doubt that a large number of the cattle in this state, especially dairy animals, harbor this disease, and steps should be taken to suppress or eradicate the same. The animals now free from this affection should at least be protected. Tuberculosis is a menace to man as well as to domestic animals. The disease is not as prevalent, however, in this state as in most of our eastern states, therefore, something should be done to check the spread before it is too late.

Numerous animals used for consumption have also been inspected post-mortem at different slaughtering houses in order to get further evidence as to the prevalence of this disease in our state. A bulletin on this subject is in course of preparation.

That this Department is in touch with the live stock interests of the state is evidenced by the constantly increasing correspondence along the line of animal diseases. Inquiries come from

nearly all parts of the state regarding the control, prevention, eradication and treatment of prevalent diseases. There being no State Veterinarian, the Station is the only recourse people have. Many of the requests for the investigation of disease cannot be granted owing to the lack of time and means at our command: besides individual cases cannot be taken up by the Station unless the community or a number of people in it are directly interested.

The most prevalent diseases brought to our attention are, tuberculosis, contagious abortion, black leg (systomatic anthrax) glanders, cerebro spinal meningitis, influenza, distemper (strangles), hog cholera, mange, lumpy jaw (actinomy cases) and cases of poisoning. We have ample proof that some of these diseases can be transmitted to human beings through contact as well as from the use of diseased meat and dairy products, thus endangering human lives as well as animals. I have often been called out by the State Board of Health to investigate reported outbreaks of contagious diseases in different parts of the state, Some of these have been attended to, however, this should not be part of the station work unless specially arranged for.

The total valuation of live stock in this state, excepting fowls, was estimated last year at $20,267,965. We need a state veterinarian to look after and protect the live stock interests of this state. The duties of this office could be efficiently and economically carried on in connection with the College and Experiment Station, as we have ample facilities for chemical, botanical and bacteriological investigations that such work would require.

Other experiments were planned, but owing to the diseases not appearing during this year, were not carried out. Experimenting on animal diseases is different from most all other lines of experimentation. The disease must exist long enough and among a sufficient number of animals to properly carry on investigations.

Considerable of my time is required to look after the animals on the college farm. The stock is increasing and more is being added. At present all the animals on the farm are in good condition and prospects for the future are promising.

Respectfully submitted,

H. J. FREDERICK,

Veterinarian.

DEPARTMENT OF IRRIGATION ENGINEERING.

To the Director:

I have the honor to submit herewith a brief report of the work of the Department of Irrigation and Drainage for the fiscal year ending June 30th, 1906.

The cooperative irrigation work on the Greenville and Fankhauser farms at Logan, has been continued in accordance with the general plans inaugurated in 1900 and reported in the annual report for 1901. A marked improvement was made during the past spring on the Greenville farm in that some of the plats were leveled, thus permitting more even distribution of irrigation water. There were such minor changes made in the details as naturally became necessary from year to year. The plans as outlined have been followed as carefully as possible and every precaution taken to prevent errors.

This department in cooperation with the State Engineer and the U. S. Department of Agriculture, undertook a study of the duty of water as found in practice in the vicinity of Ogden and Morgan on the Weber River Irrigation System. This work has been carefully done so far and gives promise of yielding valuable results.

In connection with the duty of water studies, some experiments are now being conducted for the purpose of demonstrating the best use of irrigation water in cooperation with the State Industrial School, the Weber County Poor Farm, the State School for the Deaf and Blind, the Wasatch Orchard Company and several private individuals. Similar demonstration experiments are being conducted in Sevier, Tooele, Utah, and Box Elder Counties.

The plans for our cooperative work with the Office of Experiment Stations of the U. S. Department of Agriculture, provide for investigations of the methods of canal management and of water distribution to the canal companies and to the individual users. The object of this investigation is to ascertain the best present practice with a view of presenting to the people of the State the best practice in canal management. It is now admitted that the canal having the best supervision, irrigates more land

with the same amount of water than does a canal having indifferent management.

Our drainage experiments have been extended and improved in Cache, Washington and Emery counties. These drainage systems are now in successful operation. The land under the drainage system in Cache Valley is cropped this year to sugar beets and in no instance does the crop appear other than thrifty with a promise of a large tonnage per acre. This was land which a very short time ago was raising wild hay where the total return did not reach more than $15.00 per acre. As a result of our work in this county several hundred acres of land have been tile drained during the past year and a half.

The drain in Emery county has been installed but the ultimate results cannot at this time be stated. This land a year ago was so boggy that it was impossible to get on it with a team. During the past spring a great part of this land was plowed and the indications are that next spring this land will be in good condtion for general farming. If this experiment is as successful as it now promises, it will prove of inestimable benefit to the people in that part of the State.

The drains in Washington county were installed during the past winter and are now working successfully. The final result of the experiment will be known in another year.

Additional investigations are being made in Box Elder, Weber, Sevier and other counties. Some of these investigations contemplate the improvement of considerable areas to be undertaken under the district drainage law. It is found that our present district drainage law is defective in some particulars, especially in that the number of signatures required is too great and further, it does not provide sufficiently for the condemnation of land required for an outlet. It is to be hoped that some amendments to this law will be made by the State Legislature of 1907.

Our investigations on the rise and fall of ground water as affected by irrigation are still being carried on in this connection with our drainage experiments and additional data on this subject are being secured in connection with our irrigation work on the Weber river.

The plans for our cooperative work with the federal government provide that during the fall of the present year ex-

periments shall be undertaken in the irrigation of land during the late fall, winter and early spring, or by the methods of the so-called "Winter Irrigation." The object of this work is to store within the soil sufficient moisture during the non-growing season to produce a profitable crop the following summer. This investigation will include observations on the effect of this method of irrigation on the summer flow of the streams affording drainage to the land so irrigated. It is claimed and is very probable that part of the water applied to these higher lands during the winter and early spring will, by seepage, ultimately reach the drainage channel, resulting in a greater flow in the stream during the latter part of the summer. This question is worthy of considerable experimentation.

The plans further call for a collection of information on the construction of farmers' reservoirs with a view of recommending to the people such methods as will enable the individual farmers to store at comparatively slight expense the flood waters issuing from a great many of our so-called "Dry Washes" or dry ravines.

Investigations are also now being planned for a study of the development of underground water supplies for purposes of irrigation and such investigations will be of especial value to those engaged in dry farming. There have been in Utah practically no investigations regarding the under-flow, or as some call it "Seepage Flow" from our dry canyons. In other states there are numerous instances where large and valuable water supplies have been secured by intercepting such underflows and this problem is worthy of the consideration of the people of Utah.

The success of the irrigation and drainage work of this department and the encouragement it is receiving from the people of the State, is highly gratifying, and I urge that our present idea of cooperation with the Federal and State Offices and the farmers of the State be continued.

Respectfully submitted,
WALTER W. McLAUGHLIN,
Irrigation Engineer.

DEPARTMENT OF ENTOMOLOGY.

To the Director:

The work of the Entomological Department for the year ending June 30, 1906, has been mainly along two general lines. A continuation of the investigations of the value of spraying for the codling moth and a beginning of the study of the insects of the Sugar Beet. The work on sugar beet insects was undertaken in cooperation with the Bureau of Entomology of the Department of Agriculture, which arrangement made it possible for me to transfer my instruction work and to devote nearly my whole time to these investigations.

Codling Moth Work.

As the result of three successive years of tests in Cache Valley the protective value of the early syrays has been fully demonstrated for the northern portions of the State at least. The Smart Orchard which was used in the experiments of 1904, gave in 1905 as the result of two early sprays on a heavy crop a total wormy for the year of almost exactly 2 per cent. The Hatch orchard gave equally good results on commercial varieties and on Pewaukee and Wolf River, two of the wormiest varieties known, the total for the year was only 6 per cent. Mr. D. M. Campbell of Providence has continued the methods used on his orchard in the experiments of 1903 and his results the past season were far better than he formerly attained by continuous spraying. Other orchards where this method was used for the first time, the past season gave remarkably high averages at picking time. Of these Mr. Moroni Mortenson's of Bear River City and Mr. Henry Seeger's of Tremont were under obesrvation during the season and the results were very gratifying.

There was still one other question with reference to the protective power of early sprays which had not been tested in this locality, and that was whether early spraying alone would be sufficient to save a very light crop following a very heavy one. Even where the worms had been kept down to a small per cent of a heavy corp it was thought possible that there

might be enough left to almost destroy a small crop following. To determine this point and to complete the test of the cumulative protecting power of thorough early spraying it was decided to spray the Smart and Hatch orchards again this season.

In order to test the general applicability of this method to the warmer sections of the State, a test was made on the orchard at the central experiment farm at Lehi, and another in cooperation with Mr. James Fisher of Provo upon his orchard. Besides these, partial tests were made on orchards on Provo Bench and at Moab. Complete records are being kept of the work at Lehi and of that on Mr. Fisher's Orchard at Provo, while the others are visited as circumstances will permit.

Sugar Beet Insects.

The work on sugar beet insects, commenced last year, was taken up again this season in cooperation with the Bureau of Entomology. The main object of this season's work will be to discover the life history and methods of attack of the beet leaf hopper and with this knowledge as a basis to try to discover some remedy or method of prevention. In connection with this study all other injurious insects of the beet will be investigated as they appear.

The cold wet spring was very unfavorable to the reappearance of most of the beet pests and seemed to be particularly so for the leaf hoppers. Up to the present time very little damage has been done to the beet crop, in fact the leaf hopper has appeared in such small numbers in the northern part of the State that it has been necessary to transfer this work to the central and southern part where a number of experiments are in progress.

Minor Investigations.

A number of other insects were under observation during the season as occasion permitted. Several local outbreaks were reported and investigated. The cold wet spring was very unfavorable to the development of "warrior" grasshoppers and no damage from this source was reported. The wet sea-

son or some other equally effective agency reduced the numbers of the Strawberry leaf-roller so that they did little damage. On the other hand the Strawberry Crown girdler, the Peach tree borer, the Pear slug, several species of Aphis, and the native grasshoppers, that come on later in the season were as injurious as ever.

Only one new pest was discovered this season, the red louse of the apple, and that in only a few localities. This louse has proved very troublesome in the fruit growing districts of Oregon and Idaho and should be carefully studied the coming season.

Miscellaneous Work.

A number of valuable additions have been made to the collection of injurious insects and their work. This collection can be made of much value to the people of the State if properly worked up and labeled for exhibition. A number of photographs have been taken which will be made use of in future publications.

The work on the codling moth during the season of 1904 has been compiled and published as Bulletin 95. The work of the season of 1905 has all been tabulated and will be prepared for publication shortly. A bulletin on the insects of the sugar beet is in preparation. It will include the results of this seasons investigations.

The correspondence of the department has increased in volume and the tone of the inquiries seems to indicate a much better understanding of the aims of the department than formerly prevailed.

During the past year lectures have been delivered before thirty farmers' institute meetings mainly upon the codling moth and sugar beet insects. The meetings of the North West Fruitgrowers Association, the Idaho State Horticultural Society and our own State Horticultural Society have been attended and in each case addresses have been delivered. In addition to this a number of articles have been prepared for the agricultural press and spraying demonstrations have been given in six of the leading fruit growing districts.

Plans and Equipment.

The Department of Entomology has been getting along with very little in the way of equipment partly because it was a new department and such things come slowly, and partly because the investigations first undertaken were not of a nature requiring much in the way of equipment. The time has, however, arrived when some form of an Insectary is necessary in order to carry on the work that should be undertaken. A number of the most pressing problems connected with the sugar beet investigation cannot be solved without some place where artificial conditions with reference to heat and moisture as well as isolation of food plants and insects to be studied can be had at will. Many other problems awaiting solution cannot be undertaken without this equipment.

An Insectary of modern green house construction together with an office and work room of brick could be erected for $1500.00 to $2000.00. Such a building could also be used for all breeding work along insect lines, for the propagation of laboratory material and for demonstration work in spraying.

The amount of time devoted to station work by this department should also be increased. The present arrangement provides for but little more than the three months of summer vacation from College work. While satisfactory work in entomological lines must begin with the growing season and continue until the end and even during the winter, some time must be spent in compiling results and in arranging them for publication.

The lines of work already under way should be continued, especial emphasis being placed upon the study of the sugar beet insects and on the spraying experiments in the warmer sections of the State.

Mr. E. G. Peterson, Assistant Entomologist, was granted a leave of absence for study during the summer and with the exception of two or three days during the first spray, his work has been taken by Mr. Jno. R. Horton, a student in Entomology. Mr. Horton has taken up the work readily and I am pleased to recognize his efficient aid in the general office work, and in the case of the spraying experiments carried on at the home station. Mr. Wm. Larson has had charge of the records

and spraying at the Central Experimental Farm and has done very careful and conscientious work.

Respectfully submitted,
E. D. BALL,
Entomologist.

DEPARTMENT OF CHEMISTRY.

The work of this department was largely confined to the irrigation investigations, the dry farm investigations, the analysis of soils from sub-stations, and the tabulation of results of the work of the past several years of this department and considerable of that of other departments. So much of the time was consumed in bringing up back analytical and tabulation work that very little new work could be undertaken. By the close of the year considerable progress had been made in this but still there was much left to be done. With the large mass of data collected on the irrigation and the dry farm work during the last three years, it was necessary before a systematic study of the data could be made to bring these together in such a tabular form that all data on any plat or experiment could be reviewed without the tedious search through isolated tables and notebooks. A scheme to accomplish this was elaborated and during the last half of this year much of the regular help and of extra student help was used in making out these tables.

We find it not altogether satisfactory to depend so largely as in the past upon temporary student help, especially where the time given to Station work comes at indefinite times. I deem it advisable to strive towards getting more of our help in the form of full-time and more permanent employees.

In July, 1905, Mr. Robert Stewart, Assistant Chemist in the Station, was made Assistant Professor of Chemistry in the College. The instructional duties assigned him occupied so much of his time that very little remained in which to carry on Station work. Mr. J. E. Greaves was employed on full time, as during the preceding year. During the summer of 1905, for a short time, Professor J. C. Thomas was engaged in soil survey work in Millard County.

The soil survey work that was started last year on the Southern Experiment Farm was continued this year. The chemical

analyses were nearly completed. Some chemical work was done on the Millard County soil samples collected in the partial survey mentioned above. This work was especially directed towards a study of the nature of a hardpan encountered in some localities in that section of the State.

In the **irrigation investigations** in which the Chemical Department cooperated with other departments, we continued making analyses of many of the crops in an effort to determine the effect of different amounts of water and different times and manners of application upon the composition of the crops. In these irrigation investigations we aim to study the effects on quality as well as quantity of yields. In a farther study of the quality of some crops, the Chemical Department made some cooking tests on potatoes, carrots and onions, under carefully controlled conditions. Miss Inez Powell of the Department of Domestic Science rendered valuable assistance in this. As it seemed impracticable during the summer of 1905 to have any members of the Agronomy or the Irrigation Engineering Departments to exercise that oversight of the Greenville irrigation work which is necessary to correllate the work of the several departments concerned, this duty fell to Mr. Stewart of the Chemical Department. The work which was started during the previous year in studying the development and movement of nitrates in the soil under irrigation was continued this year. To collect samples for this, and also for moisture determinations, one man was employed during most of the growing season.

In the **Arid Farming Investigations** we continued analyzing many samples of the crops produced and making milling tests of the wheat. Many soil samples were taken on each of the six Arid farm sub-stations and sent in to the laboratory for moisture determinations, to furnish data for the closer study of the effect of various methods of cultivation and cropping on the amount and distribution of moisture in the soil.

A series of samples of soil were taken for nitrate determinations from the **alkali farm near** Salt Lake City, on which the Station in cooperation with the Bureau of Soils has for several years been conducting an experiment in the reclamation of alkali land. The amount of nitrates was remarkably low, probably due to the excessive washing of the soil to get rid of the

alkali and to the poor physical condition which is unfavorable to the nitrification processes in the soil.

The **Sugar Beet Seed Improvement Work** again required the testing of many beets for the comparison of varieties and the selection of mother beets.

In studying the efficiency of cream separators under various conditions the Chemical Department was called on to co-operate with the **Animal Husbandry Department.**

The **Photography Work** for the Station and the College continued to be in charge of the Chemical Department, requiring much of the time of assitants.

Besides these regular lines of work, there were many **miscellaneous** questions arising during the year which required chemical work. Numerous samples of soil, water, crops and food articles, were sent in for examination by citizens of the state. Many of these could not be taken up by the Station because they were purely of a private character. In some cases the requests were for work that was of sufficiently general interest among the farmers to justify its being done at public expense, but we had to refuse it on account of its interference with our regular lines of experimental work. Our policy is to refuse as Station work altogether such work as is of private interest only, even though the work bears directly on agriculture. Investigational work along agricultural lines which is of general interest to a rural community or to the state at large, we consider within the province of the Station, but we can handle only a limited amount of this.

Reported by,
P. A. YODER,
Chemist.

FINANCIAL STATEMENTS.

HATCH FUND.

UTAH AGRICULTURAL EXPERIMENT STATION

In Account With

THE UNITED STATES APPROPRIATION, 1905-1906.

Dr.

To Receipts from the Treasurer of the United States as per appropriation for fiscal year ended June 30, 1906, as per act of Congress approved March 2, 1887		$15,000.00

Cr.

By Salaries	$ 6,206.89	
Labor	3,062.77	
Publications	438.63	
Postage and Stationery	487.49	
Freight and Express	73.51	
Heat, Light, Water and Power	15.00	
Chemical Supplies	396.42	
Seeds, Plants and Sundry Supplies	393.53	
Fertilizers	127.75	
Feeding Stuffs	1,063.07	
Library	29.92	
Tools, Implements, Machinery	282.73	
Furniture and Fixtures	177.67	
Scientific Apparatus	567.05	
Live Stock	865.87	
Traveling Expenses	481.16	
Contingent Expenses	27.50	
Buildings and Repairs	303.04	$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Utah Agricultural Experiment Station for the fiscal year ended June 30, 1906; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00 and the corresponding disbursements $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving nothing.

And we further certify that the expenditures have been solely for the purpose set forth in the Act of Congress March 2, 1887.

(Signed) JOHN T. CAINE, JR.,
WILLIAM PETERSON,
Auditors.

Attest: J. A. BEXELL,
Custodian.

I, J. A. Bexell, Secretary of the Board of Trustees of the Agricultural College of Utah, do hereby certify that John T. Caine, Jr., and William Peterson were duly appointed to audit the accounts of the Utah Agricultural Experiment Station for the year ending June 30, 1906.

J. A. BEXELL,
Secretary.

ADAMS FUND.

UTAH AGRICULTURAL EXPERIMENT STATION

In Account With

THE UNITED STATES APPROPRIATION, 1905-1906.

Dr.

To Receipts from the Treasurer of the United States as per appropriation for fiscal year ended June 30, 1906, as per Act of Congress approved March 16, 1906		$ 5,000.00

Cr.

By Salaries	$ 919.59	
Labor	209.05	
Chemical Supplies	456.15	
Seeds, Plants and Sundry Supplies	38.67	
Feeding Stuffs	99.07	
Library	1,477.34	
Tools, Implements and Machinery	72.08	
Furniture and Fixtures	144.68	
Scientific Apparatus	1,172.07	
Live Stock	8.80	
Traveling Expenses	209.08	
Buildings and Repairs	15.36	
Balance	178.06	$ 5,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Utah Agricultural Experiment Station for the fiscal year ended June 30, 1906; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $5,000.00, and the corresponding disbursements $4,821.94; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving $178.06 unexpended.

And we further certify that the expenditures have been solely for the purpose set forth in the Act of Congress approved March 16, 1906.

(Signed) JOHN T. CAINE, JR.,
WILLIAM PETERSON,
Auditors.

Attest: J. A. BEXELL,
Custodian.

SUPPLEMENTARY REPORT.

STATION MISCELLANEOUS FUND.

Dr.

To Receipts from Other Sources Than the United States for the Year Ended June 30, 1905.

Balance on hand July 1, 1906	$ 378.48
Received from the Sale of Farm Products	2,691.59
	$ 3,070.07

Cr.

Labor	$ 57.37	
Publications	76.93	
Feeding Stuffs	23.12	
Contingent Expenses	37.00	
Balance on hand	2,875.65	$ 3,070.07

ARID FARM FUND.

July 1, 1905, to June 30, 1906.

Receipts.

From State	$5,954.42	
From San Juan County Refund	3.25	
From Farm Sales	144.54	$6,102.21
Overdraft June 30, 1906		308.63
		$6,410.84

Expenditures.

Salaries	$1,281.54	
Labor	3,019.74	
Publication	89.32	
Postage and Stationery	127.45	
Chemical Supplies	112.58	
Seeds, Plants and Sundry Supplies	123.77	
Tools, Implements and Machinery	532.14	
Scientific Apparatus	38.69	
Traveling Expenses	358.57	
Contingent Expenses	145.65	
Buildings and Repairs	3.58	
Freight and Express	162.50	$5,995.53
Overdraft, July 1, 1905		415.31
		$6,410.84

SOUTHERN UTAH EXPERIMENT STATION FUND.

May 1, 1905, to June 30, 1905.

Receipts.

From State	$ 850.05	
Overdraft, June 30, 1905	433.30	$1,283.35

Expenditures.

Salaries	$ 390.00	
Labor	625.75	
Publication	.94	
Postage and Stationery	35.90	
Chemical Supplies	2.40	
Seeds, Plants and Sundry Supplies	25.02	
Feeding Stuffs	13.39	
Tools, Implements and Machinery	6.30	
Traveling Expenses	152.00	
Contingent Expenses	10.60	
Buildings and Repairs	21.05	$1,283.35

July 30, 1905, to June 30, 1906.

Receipts.

From State	$3,387.25	
State Board of Horticulture	8.70	$3,395.95
Overdraft on Treasurer, June 30, 1906	$ 78.55	
Less cash in hand of J. T. Atkin	25.00	53.55
		$3,449.50

Expenditures.

Salaries	$1,770.00	
Labor	596.95	
Postage and Stationery	81.35	
Chemical Supplies	9.82	
Seeds, Plants and Sundry Supplies	245.18	
Feeding Stuffs	82.76	
Tools, Implements and Machinery	48.20	
Scientific Apparatus	32.19	
Traveling Expenses	112.40	
Contingent Expenses	20.30	
Freight and Express	17.05	$3,016.20
Overdraft, June 30, 1905		433.30
		$3,449.50

CENTRAL UTAH EXPERIMENT STATION FUND.

July 1, 1905, to June 30, 1906.

Receipts.

From State Appropriation	$4,766.90	
From Sales (trees)	14.50	$4,781.40
Overdraft on Treasurer, June 30, 1906	$ 426.56	
Less cash in hands of Ola Larson	25.00	401.56
		$5,182.96

Expenditures.

Salaries	$1,428.70	
Labor	1,382.64	
Publication	—	
Postage and Stationery	99.60	
Chemical Supplies	85.86	
Seeds, Plants and Sundry Supplies	636.56	
Fertilizer	37.00	
Feeding Stuffs	60.59	
Tools, Implements and Machinery	619.74	
Scientific Apparatus	73.08	
Traveling Expenses	194.80	
Contingent Expenses	533.05	
Buildings and Repairs	12.97	
Photography	6.10	
Freight and Express	12.27	$5,182.96

IRRIGATION AND DRAINAGE INVESTIGATION FUND.

April 1, 1905, when work was begun under this fund, to June 30, 1905.

Receipts.

From C. F. Brown		$ 83.33
Overdraft, July 1, 1905		1,340.49
		$ 1,423.82

Expenditures.

By Salaries	$ 497.49	
Labor	544.32	
Postage and Stationery	111.60	
Chemical Supplies	15.54	
Seeds, Plants and Sundry Supplies	65.30	
Scientific Apparatus	19.55	
Traveling Expenses	150.65	
Flumes and Weirs	17.57	
Freight and Express	1.80	
	$ 1,423.82*	$ 1,423.82

*Of this amount $212.14 was expended for Sugar Beet Seed Improvement work and temporarily charged to this fund, but refunded during the succeeding year.

IRRIGATION AND DRAINAGE INVESTIGATION FUND.

July 1, 1905, to June 30, 1906.

Receipts.

From State	$ 7,268.27	
From U. S. Government, I. & D. Investigations	1,475.00*	
From U. S. Government, refund for expenditures in the Cooperative Sugar Beet Seed Improvement Work, temporarily charged to this fund	518.24**	
From C. F. Brown	7.82	
	$ 9,269.33	$9,269.33

Expenditures.

Overdraft, June 30, 1905	$ 1,340.49	
Salaries	3,884.71	
Labor	1,562.34	
Publications	60.92	
Postage and Stationery	48.24	
Chemical Supplies	55.85	
Seeds, Plants and Sundry Supplies	314.56	
Fertilizers	5.00	
Photography	44.92	
Tools, Implements and Machinery	21.10	
Scientific Apparatus	238.31	
Traveling Expenses	553.44	
Contingent Expenses	76.00	
Flumes and Weirs	498.89	
Freight and Express	26.30	
	$ 8,731.07***	
On hand June 30, 1906	538.26	
	$ 9,269.33***	$ 9,269.33

*The balance of the amount expended by the U. S. Government in this cooperative work did not pass through this office and is therefore not accounted for in this statement.

**Of this refund, $212.14 is for expenditures prior to June 30, 1905, and $306.10 for expenditures during the year ending June 30, 1906.

***Of this amount $403.18 was expended for Sugar Beet Seed Improvement Work, $306.10 of which has been refunded as per note above, and $97.08 is to be refunded during the next year.

SUMMARY OF ALL FUNDS.

Receipts.

U. S. Government, Hatch Fund	$15,000.00	
U. S. Government, Adams Fund	5,000.00	
Balance on hand July 1, 1905, Station Miscellaneous Fund	378.48	
Sales of Farm Products, Station Miscellaneous Fund	2,691.59	
State Appropriation for Irrigation and Drainage Investigations	7,268.27	
U. S. Government, Irrigation and Drainage Investigations	1,475.00	
From C. F. Brown, Irrigation and Drainage Investigation	7.82	
U. S. Gov't, Sugar Beet Seed Improvement work	518.24	
State Appropriation of Arid Farming Investigations	5,954.42	
From sales of products of Arid Farms and refund	147.79	
State Appropriation for Southern Experiment Station	3,387.25	
From State Board of Horticulture for Southern Experiment Station	8.70	
State Appropriation for Central Experiment Station	4,766.90	
From sales, Central Experiment Station	14.50	$46,618.96

Overdraft, June 30, 1906, Arid Farm Fund.......$	308.63	
Overdraft, June 30, 1906, less cash on hand, Southern Experiment Station	53.55	
Overdraft, June 30, 1906, less cash on hand, Central Experiment Station	401.56	763.74
		$47,382.70

Expenditures.

Overdraft, July 1, 1905, repaid, Irrigation and Drainage Fund ....$	1,340.49	
Overdraft, July 1, 1905, repaid, Arid Farm Fund	415.31	
Overdraft, July 1, 1905, repaid Southern Experiment Farm	433.30	$ 2,189.10
Hatch Fund	$15,000.00	
Adams Fund	4,821.94	
Station Miscellaneous Fund	194.42	
Irrigation and Drainage Fund and Sugar Beet Seed Improvement	7,390.58	
Arid Farm Fund	5,995.53	
Southern Experiment Station Fund	3,016.20	
Central Experiment Station Fund	5,182.96	41,601.63
Balance unexpended, Adams Fund	178.06	
Balance on hand, Station Miscellaneous Fund...	2,875.65	
Balance on hand, Irrigation and Drainage Fund.	538.26	3,591.97
		$47,382.70

REVIEWS OF BULLETINS.

Press Bulletin No. 11.—Extermination of Prairie Dogs.

In this bulletin attention is called to the depredations committed by prairie dogs or ground squirrels, especially on dry land farms, and by pocket gophers in some irrigated sections. The announcement is made that the Station is prepared to furnish, ready mixed, a poison preparation which has proved very effective on the experimental arid farms of this State and in other states where it has been tried.

Bulletin No. 94.—Pig Feeding Experiments.

This bulletin is a compilation of data obtained from pig feeding experiments which covered a period of ten years.

A few general points in pig management are first discussed. Part I of the bulletin deals with some general topics, as follows:

I. The Value of Exercise.

The effect of exercise upon rate of gain was tried with several feeds. When fed grain alone, exercise proved advantageous, but when grass or lucern was added, those in small pens gained faster.

II. The Value of Grass and Pasture.

Full grain rations with pasture, grain and skim milk on pasture and in pens and part grain ration on grass were all tried. Besides these, some were fed on pasture alone, and others were fed part grain ration in pens. Grass alone did not furnish enough food for hogs, and where some grain was added, hogs made better use of pasture. When feeding

full grain ration to hogs, the fastest gains were made where hogs had run of pasture. By feeding part grain ration to pasture, more use of the grass was made, and cheaper gains resulted.

III. The Value of Dairy By-Products.

Eleven tests with 40 hogs were made in feeding grain and skim milk in pens and on pasture. For most rapid gains a ration of skim milk and grain in proportion of one pound grain to five of skim milk was found best. When grain is high slower but more economic gains are made by feeding more skim milk and less grain. Skim milk alone did fairly well on pasture, but is not advised for pen feeding. Grass or lucern hay proved better than sugar beets as hog food.

IV. Value of Kind of Grain.

Wheat proved most economical as to grains, while with corn meal and barley rations the results were in favor of barley. Better gains were made in all cases where grass was fed with grains.

Part II deals with dairy by-products as food for fattening hogs. Two experiments were conducted in which skim milk was fed in different amounts along with grains. Against these, several pens of hogs were fed on skim milk alone and grain alone. One lot of these experiments was conducted in pens and the other on pasture.

Conclusions to Part II:

(1) From all points of view a ration of skim milk and grain, fed in the proportion of one pound of grain to five pounds of skim milk for young animals; and one pound grain to three pounds of skim milk for older animals, proved a better ration than a larger proportion of milk.

(2) Adding skim milk to a grain ration enabled the hogs to gain more than twice as rapidly as when fed grain alone, and each 100 pounds of skim milk effected a saving of 13 to 17.2 pounds of grain, according to the way in which the milk was fed.

Part III is an experiment in feeding whole milk to hogs. Three young Berkshires were fed all the whole milk they would take for 50 days. The whole milk proved a costly food and if 15 to 20 cents can be obtained for butter, it is better to feed the skim milk. By comparison it was found that 50 pounds of whole milk is equal to 100 pounds of skim milk.

Bulletin 95.—Codling Moth Work in 1904. The Relative Value of Early and Late Sprays.

The plan of the year's work discussed in this bulletin was to discover the following things: 1—The value of early sprays on the first brood. 2—The value of early sprays on the second brood. 3—The value of the late sprays on the second brood. 4—How and where the different sprays kill the worms. 5—A method of accurately separating the work of the first brood of worms from that of the second.

For this work two orchards were used, one in Providence, owned by Mr. Hoggan, and one in Logan, owned by Honorable Thomas Smart. The Providence orchard was a neglected one and was used to test the value of the late sprays, when applied alone. The Logan orchard had been previously well sprayed. Paris green (1 pound to 150 gallons of water), with a large sized barrel pump, was used. Careful record was kept in both of these orchards with the following results:

The two early sprays killed almost nine-tenths of the first brood of worms. Enough poison remained from the early sprays to kill two-thirds of the worms of the second brood. The three late sprays killed

three-fourths of the second brood of worms. About two-thirds of all the worms of the year go into the blosson end of the apples. In a neglected orchard, or where there are neglected orchards near, it will be necessary to spray five times. In a good orchard, more than a quarter of a mile from an infected one, two early sprayings and banding will be successful. The secret of spraying is to fill the calyx cups.

Bulletin No. 96.—Care of Milk on the Farm and the Manufacture of Butter and Cheese.

Bulletin 96 contains a general discussion of the various phases of milk production. It deals with the importance of cleanliness of stables, yards, cows and utensils. The methods of caring for milk, cream and cows are briefly described. The various steps involved in the manufacture of butter and cheese are also taken up and described. From an investigational standpoint experiments were carried on in canning and paraffining cheese. The author concludes that if the cost of canning cheese cannot be reduced nothing is gained from it. By canning cheese, water does not evaporate, and the quality of canned cheese is practically the same as that of uncanned. Experiments were also conducted on the effects of paraffining cheese under Utah conditions. The unparaffined cheese scored a little higher than did the paraffined, but lost more water during the curing period (three months). The unparaffined cheese lost 7.6 per cent in weight, while the paraffined lost only 3.7 per cent. The author concluded that by paraffining cheese a saving of 22½ cents per hundred pounds of cheese can be effected, excluding the cost of labor.

Some experiments were carried on to compare the Babcock test for fat in skim milk as compared with the gravimetric chemical analysis. It was found that the chemical test produced on an averave of 1-10 per cent more fat than did the Babcock test. The author also found that if milk is skimmed cold as much as 22 per cent of the total fat may be lost in the skim milk.

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LIST OF BULLETINS AND CIRCULARS ISSUED BY THE UTAH EXPERIMENT STATION UP TO JANUARY, 1907.

List of Bulletins and Circulars issued by the Utah Experiment Station up to January, 1907.

Those marked (*) are out of print January, 1907.

*No. 1. General Statement of Purposes, Work in Progress and to be Entered Upon, with Plans of Barn and Station Buildings.
*No. 2. Plow Trials.
*No. 3. Experiments with Garden Vegetables.
*No. 4. Dynamometer Tests with Wagons, and First Annual Report.
*No. 5. Potato Trials.
*No. 6. Trials of Sleds and Tillage Tools.
*No. 7. Draft on Mowing Machines.
*No. 8. Ensilage.
*No. 9. Time of Watering Horses.
*No. 10. Strawberries and Garden Vegetables.
*No. 11. Influence of Shelter on Food Consumption.
*No. 12. Horticulture.
*No. 13. Feeding Horses Hay and Grain Mixed.
*No. 14. Horticulture.
*No. 15. Soiling Steers—Green vs. Dry Food.
*No. 16. The Digestibility of Green and Dry Timothy.
*No. 17. Feeding Root Crops vs. Dry Feed.
*No. 18. Notes on Forest and Fruit Trees.
*No. 19. Feeding Ensilage vs. Dry Food.
*No. 20. Horticulture.
*No. 21. Feeding Ruminants on Grain Alone. 2. Night vs. Day Irrigation.
*No. 22. 1—Grass vs. Non-Grass Fed Pigs. 2—Exercise vs. Non-Exercise of Pigs. 3—Value of Natural Water for Crop Growth.
*No. 23. 1—Shelter of Stock. 2—Exercise vs. Non-Exercise of Stock. 3—Early vs. Late Irrigation.
*No. 24. Irrigation.
*No. 25. Fruit and Forest, Shade and Ornamental Trees.
*No. 26. Sub-Irrigation vs. Surface Irrigation; Water for Irrigation.
*No. 27. Irrigation, Early, Late and Useful.
*No. 28. The Value of Grass in the Production of Pork; Exercise vs. Non-Exercise of Pigs.
*No. 29. Irrigation—Amount of Water to Use; Relative Feeding Value of Timothy, Lucern and Wild Hay.
*No. 30. Narrow vs. Wide Nutritive Rations for Horses.
*No. 31. Time to Harvest Lucern; Mulching.
*No. 32. Roots and Plants of Farm Crops.
*No. 33. 1—Grazing Value of Variety of Grass. 2—Drilling vs. Broadcasting Grass Seed.
*No. 34. Relative Value of Corn and Oats for Horses.
*No. 35. Steer Feeding.
*No. 36. Relative Value of Wheat, Peas, Corn and Barley in the Production of Pork.
*No. 37. Fruit and Fruit Trees.
*No. 38. Preliminary Report on Seepage Water and the Underflow of Rivers.
*No. 39. Farm Irrigation, Orchard Irrigation.
No. 40. The Value of Grass and Its Relation to Exercise in the Production of Pork.
*No. 41. Tuberculosis.
*No. 42. Creaming Experiments.
No. 43. 1—Dairy Herd Record, 1894-1895. 2—Winter Feeding Experiments with Dairy Cows. 3—Some Suggestions on the Building and Equipment of Factories.
*No. 44. Alfalfa or Lucern, Its Feeding Value.
*No. 45. Vegetables and Fruits.
*No. 46. Earthen Dams.
*No. 47. The Climate of Utah.
*No. 48. Alfalfa or Lucern, Its Chemical Life History.
*No. 49. Spraying.
*No. 50. Spraying.
*No. 51. Poultry Experiments; Egg Production.
No. 52. The Chemical Composition of Utah Soils, Cache and Sanpete Counties.

No. 53. Utah Sugar Beets, 1897; Cooperative Experiments.
*No. 54. Cattle Feeding: 1—Comparison of Utah Feeding Stuffs. 2—Digestion Experiments with Shredded Corn Fodder, Lucern, Timothy and Wheat Bran.
*No. 55. Orchard Pests: Insects, Fungus Diseases; Sprays and Spraying.
No. 56. Field Experiments with Wheat, Oats and Barley. 1—Variety Tests. 2—Miscellaneous Tests.
*No. 57. By-Products of the Dairy. (a) Experiments in Pig Feeding. (b) Experiments in Calf Feeding.
*No. 58. The Chemical Life History of Lucern. Part II.
No. 59. Utah Sugar Beets for 1898.
*No. 60. Poultry Experiments.
*No. 61. Alfalfa or Lucern: Its Feeding Value; The Cutting Time.
*No. 62. Tree Planting in Utah.
*No. 63. Sugar Beets in Sanpete and Sevier Counties
*No. 64. 1—The Codling Moth. 2—A Wasp That Destroys the Apple Worm. 3—Sour Cherries. 4—The Oregon Evergreen Blackberry.
*No. 65. Plant Diseases and Insect Pests: San Jose Scale.
*No. 66. Corn Experiments.
*No. 67. Poultry Experiments.
*No. 68. Experiments with Dairy Cows.
*No. 69. The Golden Vine Pea.
No. 70. Pork Production in Utah.
No. 71. Carrying Capacities of Irrigation Canals.
No. 72, A Soil Survey of Salt Lake Valley, Utah.
*No. 73. Experiments in Butter and Cheese Making.
*No. 74. Lead Ore in Sugar Beet Pulp.
*No. 75. Arid or Dry Farming.
*No. 76. Forcing Lettuce.
*No. 77. Horse Feeding.
*No. 78. Lamb Feeding Experiments.
*No. 79. Process Butter.
*No. 80. Irrigation Investigations in 1901.
*No. 81. Poison in Water from a Gold and Silver Mill.
*No. 82. Feeding Beet Pulp to Steers and Sheep.
*No. 83. Pruning of Tree and Bush Fruits.
*No. 84. The Grain Smuts.
*No. 85. Pear Blight.
*No. 86. The Right Way to Irrigate.
*No. 87. The Codling Moth.
No. 88. The Relation of Smelter Smoke to Utah Agriculture.
*No. 89. A New Centrifugal Soil Elutriator.
*No. 90. Beet Molasses and Beet Pulp Feeding with Sheep and Steers.
*No. 91. Arid Farming in Utah.
*No. 92. Poultry Experiments.
No. 93. Agricultural Reconnaissance of the Uinta Indian Reservation.
No. 94. Summary of Pig Feeding Experiments from 1890 to 1902, with Deductions from the Same.
*No. 95. Codling Moth Work in 1904.
No. 96. Care of Milk on the Farm and the Manufacture of Butter and Cheese.
No. 97. Report on the Southern Utah Experiment Station.
No. 98. Report on the Central Utah Experiment Station.
No. 99. Irrigation and Drainage Investigations During 1905-1906.
No. 100. Arid Farming Investigations.

CIRCULARS.

No. 1. Memoranda of Plans of Arid Farm Investigations in 1904.
No. 2. Memoranda of Plans of Irrigation Investigations in 1904.
No. 3. Memoranda of Plans of Arid Farm Investigations in 1905.
No. 4. Memoranda of Plans of Irrigation Investigations in 1905.

PRESS BULLETINS.

No. 11. Extermination of Prairie Dogs.
In addition to the above an annual report has been issued for each year.

(4)

ANNUAL NUMBER EIGHT.

Utah State Farmers' Institutes

FOR THE

Year ending June 30, 1905.

The Deseret News
Salt Lake City
Utah

Utah State Farmers' Institutes

For the Year ending June 30, 1905.

Agricultural Education and Sugar Beet Culture.

BY HON. GEORGE AUSTIN.

Before the Agricultural Club of the Agricultural College, April 24, 1905.

Fellow Students:

About a year ago or perhaps a little less, in company with Professor Townsend of Washington, D. C., I visited the College. At that time I had the pleasure of meeting with a number of young men, some of whom are, no doubt, present today. I remember well the nice talk that Professor Townsend made. I was very much interested, believing that some of his remarks would be beneficial to the young men in later life.

Our government is doing a great deal for the agricultural interests of the United States in different localities. This is the duty of the government, after which it becomes the duty of the state to provide these institutions of learning and experiment stations so that the young men and young ladies, when grown up, may be better citizens and more capable in helping build up our great commonwealth, and that they may be better prepared to meet the problems that confront the people of the arid region and the pepole of Utah. We find that nearly all of the good farm lands of the country are owned and have been, in many cases, for many years. Hence it is necessary that we either divide up our large holdings and farms or take up and reclaim new ones. In fact we will have to do both.

Sugar beet growing was started, or the first ground was broken for the sugar factory, on the 22nd day of November, fourteen years ago. It was done by the Utah Sugar Factory, as

the company was known, near Lehi, Utah county. We know today what this has done for this state, what it has done for Utah county, and more particularly for Lehi city.

I have not talked in public on sugar beets since I was here before. I am very much interested in that question because it is going to revolutionize the arid districts of this country, from a farming standpoint. We find that about double the amount of money can be produced from sugar beets as from any other crop. except in a small way, such as having a few acres of strawberries or something of the kind and having a good price and market for them. But the sugar beet question in this country has gone into the thousands of acres. You people in Cache valley are not fixed as we are in Utah and some of the other counties. You have more water than you use, but the time will come when every drop of water in this county will be used. Hence the necessity that you should study to make the best use of it and obtain the biggest results. I was asked today if Lehi did not have a population of 4,000. No, only a little over 3,000. The population is decreasing; Why? Only one reason—shortage of water. We have water now at this time of the year, but in two and one half months hence, we will be suffering for want of it. This experimental work prepares our young men to solve these problems—hence the great necessity of an Agricultural College—the great necessity of our young men being in an industrial institution of this kind. There is a great demand today, and will continue year after year, for good agricultural men. Within the last few years we have sent forty-two from Lehi to different parts of the United States. We could not have sent them if we had not had the sugar factory, the factory where they had received their training. If anybody had told me a few years ago what would have been the magnitude of this sugar business today, I would have laughed at him. But generally the industry is growing. It is only fairly started. Three new factories will be started within the next year in the arid West. If this beet business did not pay the farmers, all the talking I could do, all the talking some one else could do, would not cut any figure. But if we are going to produce $50 to $70 annually per acre, each man will have to be more intelligent and better prepared than he has in the past, for the reason that we will have keener competition from foreign countries. We can only obtain these results by pre-

paring ourselves. To obtain them we must study well the soils, climatic conditions, etc. and the irrigation question also. Hence the necessity of young men taking an agricultural course so that they will be able to get into the very details of this subjeect, into the soil question ;and when we go onto a farm let us know whether it is adapted for sugar beets or something else. Twenty or thirty years ago we could take most any land we wanted in the state. At that time every man had to resort to farming, because there was, practically, nothing else to do. The soil was so easily tilled that a farmer could go on it with two small horses and break it up. In southern California, where I was traveling recently, I saw six large mules on one plow and they had hard work to pull it. The soil was a very heavy clay. Now we don't have much of this land here. The land is worked very easily, but, gentlemen, prepare yourselves for that which is to come, and you will not need one hundred and sixty acres to make a living; you can do it on twenty or thirty. I say it is a crying shame when we go through these counties and see along the road and, in many cases, across the fence, sweet clover choking out the man's crop. We will have to do different than this—there will not be room for sweet clover. This beet culture business is rectifying this better than anything else we could do.

There is a great deal to be said about this question. I suppose you have heard much. My wife says that I can talk of nothing else. It is a good argument, however, because it brings the dollars and cents. There are many young men before me who will embrace the opportunities which they have. Those opportunities only come by seeking them. Where do we go to get a good man to take charge of an agricultural question in California or some other place; where is the first place we shall go? Not to the saloons, not to the street loafers, but to the students, to the young men who are making successes. You cannot do it all here in College, you can get on a farm and do a great deal of it. There is a change of sentiment in regard to the farmer. It was but a few years since that when a farmer went to a city he was considered a little below the average man, but sentiment is changing, even in this state. There is no more honorable vocation that a man can hold than that of a tiller of the soil. I want to say that this is the best life. The

farmer has less anxiety than any business man has. I am not saying anything that would discourage you from taking any other course for the simple reason that all are needed. We need the doctor, the lawyer, the engineer, and, above all, we must have the man who grows the wheat and sugar beets, because that is the very life of this state. We find that the beet sugar crop gives great opportunities for the other crops. If we take 28,000 acres from other crops and put it in sugar beets, it gives a great opportunity along other agricultural lines, in that there will not be an over stock of some of the other crops.

Another feature in our favor is that our young boys can labor when they are small—before they are able to labor at anything else and at a time when the schools are closed. When a boy is ten years old he is very useful. Some of my own boys have followed this. One is nearly twenty now. I paid them sc much per ton. My girls have worked in the beets, also. It is no disgrace for them to work. One of them, who used to work in the beets, has been stenographer for the Idaho Sugar Company for two years. I don't want it to be that I have to carry them through this life; I want them to be in a position to fight their own battles. Hence the reason for maintaining these institutions that we are so proud of, where our sons and daughters can come and learn to prepare themselves for usefulness. This young boy of mine, whom I referred to, has charge of 2,000 acres of beets. I have drilled it into him pretty hard, I tell you. He has not been to school as much as I would like to have had him, but all are not constituted alike. Boys, young men, there is always room at the top. Work for the highest place; don't think that you can never reach it. I hope to get into some place by my energy and hard work. I hope to reach the point where the other fellow is. That is all we should have in mind.

I don't think it would be advisable for me to go into detail in regard to the beet culture. But it is something that everybody should study for themselves. Some of you will, no doubt, be in the sugar beet fields after school is adjourned. Go into it. Get a hoe or shovel and when you come back to school you will be better prepared to go on with your studies than if you neglected that side of the question If you will embrace the

opportunity to work and study the soil and to see what there is in these crops, to study the conditions from a scientific standpoint to ascertain what is necessary to produce twenty tons of beets per acre, then when you get into the fields they will be of benefit to you. I want to say that a young man going on the farm should be able to pass upon the condition of the soil, pass on the qualifications as to what should be planted there to make it successful, to know just how deep to plow the land and how to do it. I sometimes see a young man who it in a great hurry to get over the land; perhaps there is a dance and he wants to go home early in order that he can shave and get there on time. Start at the very foundation and plow the land; don't be afraid to harrow the land too much. That is something that is sadly neglected; not in the beet fields, however, but in the other crops. Suppose you are raising wheat at forty cents per bushel. A man will say that he cannot afford to do too much work on that, but with the beets it is different. In Bear River Valley three years ago there was no talk of sugar beets or sugar factory. The Utah Sugar Company built a factory over at Garland. The first year we had a hard time to get the people to plant beets. The first year there were only about 800 acres in the whole valley. We told the people that we were building a factory and that we wanted them to rally around us and raise some beets. It was discouraging to us, but the next year we got 2,900 and some odd acres. This year we have had to close contracting. We closed contracting last Saturday, and the farmers are after us every day to give them contracts for more beets. 7,000 acres of beets have been contracted. Now if those farmers had not made money in the business, do you suppose all the talking we could have done would have raised them to 7,000? It is the best crop that they have had in Bear River Valley. Take such men as the Honorable John T. Holmgren. The first year he put in only two acres of beets. We had to labor very hard to get him to do that. The next year he had about ten acres. This last year he had in a little over sixty acres and was very successful. You can go to Mr. Holmgren and he can tell you every day that he worked on his beet field, just when he irrigated it, just when he plowed it and how deep. When I went to him to get a sample of soil

to take to the World's Fair, I was very much surprised when he took me to his book and told me all about the work, expense, etc. We had 500,000 pamphlets printed and distributed for the information of people who visited the Fair. The administration at Washington is interested in the development of this irrigation question, and we are fortunate that our conditions are so favorable.

I would like to hear from Senator Barber. When I am called upon to speak, I expect the privilege of hearing from Senator Barber when he is present. I am going to take the liberty of calling on him. The senator is a man whose company I am proud to be in.

My young friends, I am very pleased to have met you. If I can say a word of encouragement at any time, I will be pleased to do so. Any time that any of you want to visit our sugar factory, you need not bring your credentials. We could show you more on the beet farm in one hour than I could by talking all day. We would be pleased to have you ask any questions that you would want to know.

I want to say before I sit down that if any of you want to ask any questions, don't be afraid to do so. I can stay here just as long as I can keep the Senator here. I will be pleased for the professors or students to question me on anything pertaining to the sugar question.

Agricultural Education.

BY HON. A. G. BARBER.

Delivered Before the Agricultural Club of the Agricultural College, April 24, 1905.

I have been much interested in listening to this thoroughly practical talk by a thoroughly practical man. He has made a success not only in raising beets but of other labors of life. I can bear witness that he can raise something else besides sugar beets. I have heard him defend your institution here with signal ability and with energy that I shall never forget. It is when men are associated together under trying circumstances that they will appreciate each other. And that was the situation which Representative Austin and I found ourselves in during the last Legislature in reference to this institution. The movement to consolidate or unite the two institutions in one got a great headway. Of course, it was to be expected that I, as a former trustee of this institution and a college friend would perhaps be a little more wide awake than some other true friends of the institution. But when we were thoroughly aroused to the situation, we found that we had some good, staunch friends. It would not be proper for me to enter into any discussion of that question today, but merely to say that Representative Austin and myself knew that it would be wrong to disrupt, in any way. the work being done in this institution. He could not visit the institution as he has done and know, as he always will know, just what is being accomplished. without being a friend of the institution.

I am certain that some observations have been made here today by Mr. Austin that will be carried into practical life. I left the farm when I was about eighteen years old. I have high appreciation of the advantages, comforts of independence found in a farmer's life, as every year I make it a point to go on my brother's farm for a short time. I enjoy it better than I would visiting any part of our country for sight seeing. I particularly like to go among the cattle and horses and other livestock to be found on a farm, and note the improvement that can be seen in

the class and quality of cattle and horses. I think the college has done a great deal in this regard. I am told in Wyoming that some of the very best strains of cattle have been obtained from the Agricultural College here. Well now, I don't know how many of you boys will decide to be farmers, but I do hope that those who decide will be leaders in that class. Of course, we learn our lessons more thoroughly by hard knocks than in any other way. I doubt very much if you could go on a farm and accomplish the work of Representative Austin and some of his sons, whom he has drilled so thoroughly; but you can go onto the farm very much better equipped than his boy was after you have had the instruction that this institution gives you. One of those railroad men who were up here yesterday told me that the very best railroad men they had were college graduates; that in order to be a successful railroad man today you must have a college education. Some of our friends in the controversy could not see that you needed anything but farming. They got an idea that you did not need to study mathematics, that you had no use on earth for literature, and that history would be absolutely unnecessary for you today. All these branches that go to make a thoroughly practical man were lost sight of entirely. You have I understand, one hundred and forty students in the Agricultural department. During the controversy I was frequently asked. "Where are your graduates from the agricultural course; we hear of them in the engineering branches, but we do not hear much about your agricultural graduates." I am informed that you have some graduates from this department who are doing good work. I was impressed with Representative Austin's remarks about some people thinking that farming was too degrading and that it was beneath their dignity. If you go into a bank, into a store or other business house, you will find mostly pale. sickly men who must go away from home every so often to build up their health. You will find their tendency is to live up to every dollar that they can earn. You will find as well that after they are worn out, they are replaced by young men who have better methods and are more capable and can do more work, who are better able to apply their minds to their work,—and what is there for such a man when he loses his employment?

Gentlemen, I congratulate you upon the opportunities that

you have; I wish I had had them, that I could have specialized along some particular line. As Representative Austin has drifted into agricultural work, I will say to you boys that he will always have a regard for this institution. He is loyal to this institution, as I believe you are, and you ought not to forget his disinterested helpful work in the Legislature last winter.

Beet Culture.

James Draper, Moroni, Utah.

First: Select a good level piece of land.

Second: Plow and harrow the land. Then have a frame about 8x14 feet, made of planks 2x8 inches, with a cross piece in the center and fastened firmly together by iron rods. Pull this leveller crossways on the land. This is the way to get the best results in making the land smooth.

Third: The time of planting the beets varies from about the 10th to the 20th of April.

Fourth: When the beets get from one to one and a half inches high, go through them with a cultivator made for that purpose. Then roll the beets with a common roller to make the land smooth and easy to work while thinning. One man and two boys can thin one acre per day.

Fifth: July first is about the time to commence irrigation, although to some extent it depends upon the weather. If the season appears as though it is going to be dry, irrigate a little earlier. If the opposite indications appear, irrigation may begin a little later. After watering has commenced it should be continued about every fifteen days.

Sixth: The time to commence digging the beets is about September twentieth. The time may vary a little either way, due to the way the crop has been cultivated and irrigated during the summer. With the aid of a beet puller, three horses, four good boys to pile the beets in rows, and four experienced boys or men to top the beets, one can dig twenty tons of beets per day.

Seventh: It is a wise plan to plant your beets next to your grain, which will insure a crop of grain with the early water, then you have the water for the beets in the latter part of the summer when they need it.

Eighth: Not only for the money, which the beets bring in, is this industry profitable, but anyone can keep his land in first class condition for other crops. The time during which the beets require cultivation comes in a period when the average farmer is

not busy with his other crops; and he receives his pay for his beets at a time when it is much needed by most of the farmers.

Ninth: The beet industry gives employment to a great many who need it.

Tenth: The people of Moroni realize each year about $13,-000.00 cash from the 225 acres of land sowed with beets.

Eleventh: In preparing your land for the second and following years do not plow your land too deep, as it turns up too much raw and cold soil. From four to six inches is deep enough. It is a very good thing to follow, immediately after the plow, when plowing four or six inches deep, with a subsoiler running in the ground twelve or fourteen inches deep, to loosen up the ground.

Twelfth: One of our successful farmers has not plowed his land for three years. After digging in the fall he hauls twelve or fifteen loads of manure per acre and in the spring he disks his land with a disk harrow then smoothes it down well with the leveler or frame made for that purpose. I think it pays to haul about twelve or fifteen loads of fine manure per acre on the ground. It should be hauled in the fall when the ground is dry or in the winter when the land is frozen, to prevent the land from being trampled and packed hard. I look upon the beet crop as the great mortgage lifter, and we the people of Moroni are looking forward to a great future for Sanpete as a sugar beet county.

Discussion.

Q. What is the average beet crop of Moroni, and how much is produced from one acre?

A. It amounted to $13,000.00 last year from 275 acres.

Q. What will it cost to thin an acre of beets?

A. About fifty cents a ton.

Q. What are beets going to be worth this season?

A. Four dollars and fifty cents per ton.

Q. How can you tell when to water your beets the first time?

A. They start to shrivel up and do not make any progress or growth.

Q. How often do you water your beets?

A. Every fifteen days.

Q. What size beet brings the best prices?

A. The smallest, or medium sized ones.

Q. Is there any way of stopping the growth of the beet?

A. Yes, if your land is so rich as to produce large beets, dc not thin them to more than five or six inches.

Q. What time do beets need the water most?

A. In July and August.

Q. In what month do they make the greatest growth?

A. In the month of August.

Q. How do beets do on alkali land?

A. They will not be a successful crop.

Q. Do you manure your land every year?

A. Yes sir.

Q. What increase do you notice?

A. You can stand at the head of the patch and see, by the color and size of the beets, where the manure has been scattered.

Q. How is lucern land, just broken up, for beets?

A. It is all right if you have the lucern well killed.

Horses.

PROF. R. W. CLARK.

Discussion at Fillmore, Utah.

We need a horse that will sell, and in this State it is the draft horse. Good draft horses, in this State, are selling for good prices. There has been a large number of buyers in the northern part of this State, buying up light horses for $40.00 to $50.00 each, while heavy horses will sell at from $300.00 to $400.00 a pair. It is the heavy horses that the market demands. The farmer should raise heavy horses rather than light horses.

Q. Stephen H. Barton, of Greenville: Do you advise breeding to a horse that has a ring bone?

A. Yes sir, I would when the horse has not got this through breeding. If the ring bone came through faulty breeding and conformation, I would not breed to such stock, but if it came through injury, it would not hurt the breeding qualities. There is a tendency to breed large animals without quality. This should not be done; we should have the quality as well as size.

Q. H. A. White, Beaver: Would you recommend cutting the foot out when you shoe it?

A. Trim it to its normal size, but do not cut away the bars or frog. Leave the bottom of the foot alone.

Q. Mr. F. D. Farnsworth, Beaver: What causes a hole in the foot, right about where a corn comes?

Q. Mr. Clark: Is she lame?

A. Somewhat. When I first noticed it, it was blood and matter in there (indicated).

A. It must have been caused by a snag or nail or something of the kind in the first place.

Q. C. D. White, Beaver: Professor, could you not kill the corn by burning it?

A. No.

Q. Stephen H. Barton, Greenville: Have you ever tried shoeing with a bar shoe?

A. Yes, but it does not answer for everything as is generally supposed.

Q. Henry F. Baker, of Minersville: What do you think of bleeding for founder?

A. I have never tried it.

Q. C. D. White, Beaver: Some people advocate using hot water, professor. We do not think that is the best, as the cold water draws from the feet the blood and keeps the pain down.

Q. Wm. H. White, Beaver: Do we understand that you can founder an animal by going through cold water?

A. Yes sir, by standing him in it when he is in a highly heated condition.

Q. Mr. Barton, Greenville: Do you ever have a ring bone on the ankle?

A. No, if a growth comes on the ankle, it must be something else. The ring bone always comes on the pastern.

Q. C. D. White: Professor, there is an enlargement that comes on the back ankle of horses around here. What do you call that?

A. A wind gall.

Q. Mr. Barton, Greenville: Give your description of a grease heel and your remedy.

A. It is sometimes caused by sluggish blood circulation, sometimes by damp, wet stables, or wet pastures, or a sudden change from wet to dry. Remove the cause, treatment is more or less unsatisfactory.

Q. H. A. White, Beaver: Do you recommend a board floor for a stable floor?

A. Yes.

Q. What is a good blister?

A. I will give you a good blister: Mercuric Iodide, 1 dram; Cantharides, 2 drams; vaseline, 2 ounces."

Q. C. D. White: We have many animals cut from wire fences right around the ankle. Will this blister take that swelling down?

A. Yes; it will help, but usually such things are very bad.

Q. John H. Barton, Beaver: Do you think that a spavin is hereditary?

A. No, but there is a tendency to it in bad conformation, which is hereditary.

Q. C. D. White: In a horse that was sound and good and is injured sufficiently to cause these marks, will it not hurt his breeding purposes?

A. No, not if the animal does not inherit the tendency to the fault. The sweeney is caused by too large a collar, an injury to one foot or something of the kind. Bathe it in hot water three or four times a day for two or three days, and then apply a blister. Give absolute rest for some time.

Q. John Barton, Beaver: We have a condition different here than in most any part, and that is the gravel. What do you do for that?

A. Poultice until puss forms, when this forms let it out and keep the sore well disinfected and inject pure tincture of iodine once or twice a week. There are many cases which can be relieved only by surgical operation, and should be treated only by well trained veterinarians.

Q. Barton: Suppose the gravel would come out just above the hoof, what would you use?

A. I would resort to the treatment just given:

Q. Stephen H. Barton, Greenville: I have a horse that is bruised on the ankle. What would you do for that?

A. I would bathe it in hot water.

Q. John T. Josephs: Does the swelling of the poll evil ever run down the jaw bones?

A. No; but the bones of the poll may be affected, in which case only a veterinarian can give proper treatment.

Q. Stephen H. Barton, Greenville: The swelling there is the poll evil, is it?

A. Yes; generally.

Q. What is the cause of colic and what is the remedy?

A. Colic is caused by a change of food, cold water, by a change of old oats to new oats, from old hay to new hay. Irregularity in care is a potent cause of colic, though some horses are naturally subject to it. For colic, cause the bowels to operate by giving a physic and injection. For physic give a quart of raw linseed oil.

Q. Stephen H. Barton, Greenville: Is there such a thing as a horse dying from bots?

A. No; though sometimes they cause colic. Treatment for the bots is unsatisfactory at best.

Q. S. O. White, Beaver: Do you think a good feed of potatoes would be good for the bots?

A. I don't know.

Q. H. A. White: We have horses here that have trouble with their water.

A. Clean out their sheath.

Q. J. H. Barton, Beaver: If a horse should die from some intestine trouble and we found by opening the horse that the bots had gone through the stomach, did he die from the bots?

A. I can't say.

A. Stephen H. Barton, Greenville: I would say no. Since reading this disease, I have changed my idea of the bots. They do not go through the stomach. They do not kill horses.

Q. In drenching horses, do you do it through the mouth?

A. Always; never drench through the nostrils, as some of the material may go in the lungs and cause serious trouble.

Q. What do you do for the worms?

A. It depends upon the kind of worms. For pin worms, give rectal injection of warm water, after which give rectal injections of mild solution of copperas. Give this treatment once a day for two or three days and follow it by giving one quart of raw linseed oil.

Q. Did you ever know a horse that was fed on lucern and grain that did not have worms?

A. I can not say; I do not recall.

Q. John H. Barton, Beaver: Did you ever try lime water for worms?

A. Just take a piece of lime about the size of your fist and slack it and let it settle a little and then pour it over the grain and you will have no trouble with worms.

Q. Robert White, Beaver: Is there much danger of foundering horses by watering them when they are warm?

A. Yes, as I explained just a minute ago.

Q. What is the remedy for lump jaw in cattle?

A. It is a disease that may be transmitted from one to another. Give ordinary size animal two drams of Potassium Iodide per day in drench or in drinking water. Continue this treatment until the eyes begin to run, and nose to water, then discontinue

the drug and give a stiff physic of salts. After three or four days, repeat treatment.

Q. Stephen H. Barton, Greenville: After it has broken do you say to do that?

A. Yes, keep on with this, and it should be supplemented by the Detmer treatment.

Q. What is black leg?

A. It is a disease which can be prevented by vaccination but not cured. It usually appears in the fall, winter or spring. It affects animals between six months and two years of age.

Q. Fred Kesler: I was going to ask you if you could tell us anything about big head in sheep.

A. No.

R. Fred Kesler, Beaver: What is good to take warts off horses?

A. I cut them off.

Q. W. H. White, Beaver: What is good to take warts off cows tits?

A. I do not know. If the warts on horses are cut off, sear the sore with a hot iron to stop the bleeding.

Q. John H. Barton. What is the best remedy for the distemper?

A. Good care with an occasional physic.

Q. John H. Barton: We have had the distemper for about a year here and it has not been among colts as heretofore but among the grown horses.

Livestock.

Discussion at Monroe, Utah, led by Professor R. W. Clark of the Agricultural College.

Q. Would potatoes be good for milch cows?

A. Yes, in moderate amounts; and price must be considered.

Q. Are there any external symptoms whereby a farmer may tell consumption in cows?

A. Not with certainty. I use the turberculin test.

Q. What method should be used to get a cow to let down her milk?

A. Kindness.

Q. Is it better to nurse calves or to feed them?

A. It is most economical to raise them on skim milk.

Q. At what age should a calf be put on skim milk?

A. When two or three weeks old.

Q. Are apples good for dairy cows?

A. They have little value for milch cows.

Q. Please give us the color of the Ayrshire cow.

A Chestnut, dun or red, variously proportioned with white

Q. Please give a cure for bloat other than the knife.

A. After a cow is bloated get her front feet high and gag her, give her salt, and put a small water hose down her throat to let off the gas. As a last resort use the knife.

Q. Give treatment for calf-bitten teats that will not easily heal.

A. Keep them dry and apply carbolized vaseline night and morning.

Q. How much milk should a calf have and how often should it be fed?

A. This depends upon the vigor of the calf; ordinarily twice a day. Give enough milk to keep the calf doing well without scouring it.

Q. What should be given the calf to develop it?

A,. Nitrogenous food and good care.

Q. What kind of grain?

A. Bran or oats.

Q. Which is better food, sugar beets or pulp?

A. Beets are preferred for calves. I never feed pulp to calves.

Q. Do you favor dehorning milch cows?

A. Yes. It makes them more tractable.

Q. What is the cure for milk fever?

A. The treatment is simple. Fever appears soon after calving. The cow gets nervous, goes down and is unable to rise. She usually lies on the right side with her nose in her left flank or on left side with nose in right flank. Never drench for milk fever. Get her in a comfortable place and secure a bicycle pump with milk tube attached. Milk the udder well out and disinfect the teats. After this has been done distend the udder well by pumping air into it through the teats. Tie a string around the end of each teat to keep the air in and then leave her alone. In five or six hours it may be necessary to distend the udder again.

Q. What remedy would you recommend for clogging of the manifolds?

A. Physic.

Q. Can apples or leaves cause cows to go dry?

A. As a single food the milk flow will be decreased.

Q. What feeding value is there in carrots?

A. Very little for cows.

Q. Does it pay an ordinary farmer to get a separator?

A. Yes, for five or more cows.

Q. What is the best breed of cow for all purposes for farmers in this locality?

A. Shorthorn, but you will find that they lean more towards beef than milk.

Q. What is the best way to get a cow to give down her milk?

A. Get into her confidence.

Q. Can you give us a few pointers on the poultry business?

A. The profits are very high. For general purpose, Plymouth Rock; and for eggs, the Leghorn. I know little about poultry.

Q. Will feeding potatoes to cows cause any decrease in the per cent of butter fat?

A. No.

Q. Do you allow calves to suck the cows at all?

A. Only the first day.

Q. What grain do you generally feed cows?

A. Bran and shorts mixed.

Q. In feeding skimmed milk to calves is there any difference in feeding it hot or cold?

A. Yes, it should be the temperature of the body.

Q. Will milk, any time before it sours, do to feed the calves. if it is warmed?

A. Yes, if properly fed.

Q. What per cent of the feeding value is lost by letting it get cold?

A. I don't know.

Q. What should milk ordinarily test?

A. 3.5 to 4.0 per cent butter fat.

Q. Could you suggest any journals that would be of interest to the farmer?

A. Hoard's Dairyman is the best I know of.

Q. How much hay will an ordinary cow consume?

A. About thirty pounds per day.

Q. How about timothy and lucern mixed up, as a feed?

A. It is a good mixture but the lucern should predominate.

Q. Why do our cows fall away in winter?

A. Lack of proper care.

Q. What is your idea in salting lucern stacks?

A. I do not favor it.

Q. How about orchard grass instead of lucern?

A. Orchard grass has not the milk making qualities of lucern, it lacks in protein.

Q. What about breeding two year old fillies?

A. Some breeders do it and recommend the practice, but a great deal depends upon the size and vigor of the animal.

Q. How about feeding the calf a little salt in skim milk?

A. Place the salt where the calf can get it at will.

Prof. Clark: Always under-feed rather than over-feed. Skim milk should be fed warm. Common causes of sours in calves are too much milk, cold milk, irregular feeding and dirty pails. Remove the cause. Give a physic of castor oil, then, after some time, a raw egg, shell and all, or parched flour or lime water in the milk. I feed calves milk till they are six months old at least. They should have plenty of hay as soon as they will take it. I

breed dairy heifers when they are fifteen months old if they are vigorous and well developed.

Q. How about exercise for young calves?

A. It is necessary for them.

Q. Any objections to calves helping themselves to hay-stacks?

A. They will do better if given only what they will eat up clean.

Q. How about mixing water with milk?

A I don't like it.

Q. Do you tie cows up?

A. Yes, for convenience sake.

Q. How many dairy cows should an ordinary man be able to care for on a farm.

A. About fifteen.

Q. Do you recommend feeding dry grain to cows?

A. Yes, the amount depending upon the condition of the cow and the kind of forage and grain fed.

Q. How about fattening pigs on sugar beets?

A. Not much is known as yet on this subject, but we have gotten $3 to $4 per ton for beets by feeding them, together with grain and skim milk, to shotes.

Q. What is the average milking season of a cow?

A. Ten months in the year, at least.

Q. Does it cripple a cow to milk her up until calving?

A. She does better by having six or eight weeks rest in the year.

Q. What would you advise in case of caked udder?

A. Give a physic, provide good care and give the udder lots of hand rubbing.

Q. How are carrots for horses?

A. Good.

Q. With our present method of raising beets would it be better to raise mangels?

A. Yes, they are more easily handled, give a larger tonnage per acre and so far as we know now possess about the same feeding value as sugar beets.

Q. What is the most profitable feed for a horse, chopped grain or whole grain?

A. There is nothing gained by grinding oats for horses, that can chew well.

Q. At what stage of maturity should lucern be cut?

A. Just when the blossoms begin to appear. If cut too early it is not matured and if too late it becomes too woody, besides there is a loss of nutriment. Cure your hay well; this is very important.

J. E. Magleby: Where you get two crops in Marysvale, they eat stems and leave the leaves, but here they eat the leaves and not the stems.

Prof. Clark: Because you let it go too long before cutting it. The lucern leaf is very nutritious and more digestible than the stem.

Q. What is your opinion of salting hay at stacking?

A. I want the hay so good that stock will eat it without salt.

Q. What is the best method of curing beet tops to make them suitable food for cows?

A. I know little about it. Dried tops are good if they do not have soil mixed with them and are fed moderately with alfalfa.

Q. Which is the more practical, to leave the tops on the ground for fertilizer or to turn the cows in and let them eat them?

A. It depends upon conditions. Tramping the ground when wet is bad. Tops should be fed with alfalfa and never as a single food. The cost of labor must be considered if the tops are gathered.

Q. What is the most profitable cow for a farmer? Jersey or Shorthorn?

A. The Jersey for the dairy, the Shorthorn for beef.

J. E. Magleby: Cattle will eat rye straw in preference to poor hay. They live well on rye straw.

Q. How about rye hay?

A. I have never been able to make rye hay that was relished by cattle and I have had considerable experience with it.

Q. What is the cause of potatoes growing green and bitter after they are pitted?

John Hodges: Too much exposure to strong light.

Q. Is there anything in the color of a dairy cow that would indicate her quality.

A. No.

Plowing and Soil Preparation.

BY GEO. A. SEAMAN, ABRAHAM, UTAH.

It is said that the training of a child should begin a generation or more before it is born. We may also claim that the preparation of our soil for the growth of crops should begin a year or more before the crop is to be planted. This is being proven correct by those who are making a success of farming and whose methods do not admit of a total failure.

The limited experience I have had in the lower Sevier valley, in what is commonly called the Deseret country, is, perhaps, not enough to qualify me as an undisputed authority on the care of the soil and consequently its productiveness unless a negative experience may thus qualify.

"Blest is he who wears the crown, of a deserved and pure success,
"He who knows how to fail has won a crown whose luster is not less."

Many of us have learned the art of failing quite perfectly. Let us study how to succeed. If I should criticise the system that has been followed in the past, I do not wish to be understood as attacking men, but the methods that have proven, in part at least. a failure. It can be shown by results that either the efforts put forth have been misdirected, or that in our soil and water we have stubborn foes that cannot be overcome, for the history of our country has been one of trial and extreme hard labor that has prematurely broken down many of our citizens.

The fact that we have adverse conditions to battle with makes it the more imperative that we listen to the teachings of the scientist in agirculture and redeem the waste places of our country and establish for it a good name. The reputation we have as an agricultural section may not be merited, but we have received it, perhaps in much the same way as the Quaker brands his dog for ill. "I will not kill thee, I will not beat thee, but I will give thee a bad

name. Bad dog!" he said as he drove him away from home. The cry was taken up on the street and was finally changed to mad dog. He was finally pounced upon and killed. Our country is not as bad as its reputation, that has maimed it nearly to death, but by careful nursing it can be revived and can yet make a rapid and healthy growth.

When beginning my farm labors, I was advised by many of long residence here that plowing is not necessary, that good crops had been raised for years without the land having been plowed, unless we can term the cut-and-cover method plowing, which indeed some do, claiming that their land is thus plowed every other year. Some, however, prefer the disk-harrow. I followed the advice given and by using the disk-harrow and hurry-up methods, I was able to plant in a very brief time some 75 acres of grain and alfalfa. The period of drouth began that season and all crops failed. The soil had not been prepared to resist drouth. My experience was the experience of nearly every one else. We failed to profit by the experience we had thus gained, and trusted to Providence to supply us with plenty of water, and our crops were again a failure. We have not yet made practical demonstration of the productiveness of our soil treated by modern and scientific methods of farming.

A year ago my plowing was stopped by frost and a small portion of land I was plowing was accidentally watered before winter set in. As soon as I could work on it in the spring, I rooted it over; I could do nothing else as my plow would not scour. By a thorough harrowing it became pulverized enough to hold the moisture sufficiently long to germinate and give a good start the barley I broadcasted upon it. The elements had worked upon it during the winter of heavy frosts, and had partially prepared it for a crop. How much better would it have been had I plowed it deep, that nature's work could have been complete. My neighbor plowed a piece of land for potatoes last spring, and as soon after watering it as posible planted his crop and harrowed it quite thoroughly, pulverizing the top soil. He did not water again, but still harvested a light yield of potatoes. The ground remained loose and somewhat moist to the depth of his plowing, which was shallow.

Two years in succession I planted alfalfa on a certain piece

of heavy clay land, covered with stubble, which, however, had never been plowed. I failed to secure a stand, but when I plowed it and gave loose ground for the plant to root in I secured a good stand that did well the second season with only one irrigation. There are those who have received good results by sowing alfalfa on stubble without plowing, but I am constrained to believe that it was under different conditions of soil and water than I am able to command.

Over most of the country where I reside we have a heavy clay top soil of about eighteen inches, with an underlying stratum of very fine sand, varying from a few inches to several feet in thickness, before we again encounter clay. This top soil before being worked is very dry and hard, so dry and hard that a crow-bar is a necessity in digging post-holes. The five or six inches of the surface, however, is finely pulverized by the elements. This loose surface can be easily plowed and utilized for a crop. In fact good crops have been raised without plowing, which has given rise to the belief of some that plowing is not necessary. This loose ground soon becomes packed and hard by watering. The under-soil turns up in cubical lumps that show no life or productiveness. As nature has shown us how she does the work by preparing a limited amount of top soil for use, why can we not take the hint and turn from greater depths the lifeless soil for her enlivening processes? This cannot be done in spring time for the season's crop, for her agents are moisture and frost. Those forces are irresistible—huge cliffs are rent asunder by them.

I believe this hard impervious soil which reaches the depth of eighteen inches can be permanently broken up by deep and thorough plowing. Last spring I plowed one piece of land deeper than any of the rest. The result of that plowing was discernable this fall, as on that particular piece I could plow any depth without striking the hard pan, which forms at the bottom of shallow plowing, except in one limited area where I did not plow deep in the spring. The ground had become quite hard, having been watered and not cultivated during the summer, but the hard-pan was absent. If a plow will not penetrate this hard-pan what can we expect of plants such as alfalfa, which must go to great depths for moisture. I know of one lucern field where one can pull many of the roots up. They are branched so near the surface and are so

small, it is necessary to water once in ten days in order to secure a poor and discouraging crop, while similar lands with well rooted plants yield fairly well from one or two waterings in twelve months. If the land is loose and moist the plants will certainly root deep. Our system of watering crops up is a failure. The ground is chilled and made susceptible to winds which dry and bake the surface so the germinating plant cannot send its shoot to the sunlight and air above. In sections of more abundant rainfall, this watering-up which sometimes requires two or three (I have known as high as four) waterings to keep the crust that forms moist enough to allow the tender shoot to get through, is not necessary. Nature does the work in her own time and the husbandman in proper season takes advantage of it. If it is necessary for us to supply moisture artificially to germinate our crops, why can we not supply it somewhere near nature's own time and then in proper season utilize it, as I did by accident on the small patch of barley spoken of before. Indeed it might not be necessary to supply moisture artificially, scant as our rain fall is, if we have our land ready to receive and retain all that does fall. Every farmer knows that his well cultivated land will receive moisture while the dry and hard uncultivated land remains dry and hard still. I venture the observation here that more land is ruined in our section by excessive watering than by drouth. We overcome our efforts at soil preparation by an unwise application of water.

While I am not prepared to state what value manure will add to our land, knowing that we have a rich soil and not knowing by actual tests whether it needs the elements supplied by barn-yard manure, I have observed that where manure is used better results are obtained. Perhaps it has helped loosen and pulverize the soil as well as supplied elements for plant growth.

If we follow the lead of those who have demonstrated the great worth of a proper preparation of soil and thereby conserve nature's forces to furnish us our crops in season, our way will not be marked by so many failures. I cannot admit that any section of Millard county is an exception to a rule that has long since ceased to be a theory, and that we do not need a thorough plowing and careful attention to our land afterwards to procure the best results. We must believe in our possibilities and then develop them into resources of profit and satisfaction. I have not en-

deavored to speak of all sections of our county, or advance theories, or give general information which others are here to do, but to speak of those local and under my immediate observation. But what will answer for our most stubborn conditions will certainly be good for our best.

Dairying.

By W. S. Bishop, Fillmore, Utah.

Dairying I presume in its crude state is as old as any other part of farming. But like all other branches, it has been improved upon from time to time, for the betterment of man. And it is for the education of man, that he may learn to get the most for the least labor, that we are here assembled.

It is only during the last few years that we here in Millard County have taken to studying the dairy business and adopting the improved methods.

I can remember not many years ago when the feeding of cat tle in the winter time was unknown, and when we could drive up cattle (beef fat) from off the range any time of the year. In those days the hay we got we hauled twenty miles, and when we got it, it was of such poor quality that cows could eat barely enough to live upon, let alone giving any milk. Many of us with large droves of cattle went without milk a part of the year. Today it is quite different. We now raise the best hay upon our farms. We have to feed from six to eight months of the year, with often no sale for either hay or cattle. Under these conditions we are forced to milk in order to live, and to undertake to farm without stock to eat up your roughage is also unprofitable.

Now I wish to discuss dairy farming from two standpoints; first, Dairying as a Profit to the Farmer, and secondly, Manufacturing and Marketing of the Product.

The farmer who undertakes to milk such cows as most of us have been breeding ever since we came to Utah will soon give up in despair and say there is no money in dairying, for the better they are fed, the quicker they are beef, and the more surely they will be sold for that, if a market can be found.

The dual cow has been discussed in Hoard's Dairyman. One you can milk, and one which will raise a good salable calf at the same time. And while I too would admire such a cow, I do not believe we will find her for the one quality is the reverse of the

other. Therefore the dairy farmer will have to give up the idea of raising fine marketable steers.

If we are going to milk for a profit, we will have to get the milk strain of cattle, which will be either a Jersey, Guernsey or a Holstein, and the calf of all these are refused by stock men. But then it does not pay to raise only your choice heifer calves, therefore we lose nothing.

These breeds have had a record as milk producers for from three to five hundred years. They have a record of from twenty to thirty pounds of butter in seven days, while with the most of ours it will take from thirty to sixty days to produce as much butter. I make these figures from the amount of milk some of our patrons bring us and from the number of cows they milk. Cows must be kept warm, clean and have a variety of the best of feed, and all they will eat of it, to give the best results. The cow is different to most of animals, for the more you can get her to eat, the better she will pay you for what she eats.

If you will show me a farmer with these improved breeds and cared for as above stated, I will show you a progressive farmer, and one who says it pays to milk.

I contend that a man should take a journal treating upon the subjects of his occupation, and Hoard's Dairyman is as good a one as I know of for the dairyman. And I believe if a man who is furnishing milk to a creamery will read that paper for six months, he will discard his "Shorthorn" and "Hereford" cows as soon as possible.

Now for the second part of this subject. Butter and cheese are served upon our tables to eat, and unless we know it is clean and free from germs we will not partake. And in order to manufacture this kind of product the dairyman and farmer must co-operate. The milker should always see to it that the udder and teats are clean before starting to milk, so that no filth can fall into the pail, neither should he wet the teats while milking as is the practice of many, for by so doing, there will be drops from the hand into the milk which will make it unfit for human consumption. Then when the milk is properly milked and properly handled after milking, it should not be allowed to stand exposed around the corral after milking. The dairyman who understands his business properly, who is as much opposed to filth himself as

he wishes his patrons to be, can make a wholesome article of food.

I contend that the creamery should be owned by the farmers, then they get all there is in it, for it is a branch of the farm, and belongs to the farm. And the more milk is made up at a factory, the cheaper it can be put upon the market. And where one district is too small to accomplish the best results, two or more, when they live in close proximity to each other, should co-operate.

The past year butter has brought better prices than cheese, and seeing the disadvantage the dairies of Fillmore have labored under, because of no butter plant, we have concluded to start one. The cause of our action is that butter always pays better than cheese for a part of the year, and we are desirous of doing the best we can for our patrons.

We have also offered stock to as many of our patrons as wish it. And we have tried to co-operate with our neighboring towns, that they with us might receive a benefit through the butter business. It costs considerable money to equip a creamery with the latest improved machinery for butter making, where the milk is pastuerized so as to kill germ diseases as well as to make a better flavored and longer keeping article. Such treatment also improves the feeding quality of the skim milk.

By the co-operation plan the product could be marketed cheaper, it would take less machinery, and we could do business with larger firms (who do not like to handle many brands) with better prices. And many other advantages too numerous to mention which would lessen the expense and add to the price of milk, would accure to the farmers by this method. These, ladies and gentlemen, are my conclusions, after years of study and labor.

Poultry Raising.

By Andrew Peterson, Manti, Utah.

A number of years ago a thought struck me that people were not getting out of their land and labor what they ought. I started out in the poultry business many times but failed in most of my attempts, but ignorance was the cause. In a few years I was rewarded for my labor. I started out with an income of twenty-five dollars per year. One day I was looking at my hens and wondering if they were paying for their feed, for they were as fat as seals. I then sent for a poultry journal for I felt that if I did not make something out of these hens I might as well sell them. After I had read a few editions of this journal, I made up my mind to buy four hundred hens. I then bought an incubator, and the first hatching amounted to fifteen chickens. I then made a standing offer to anybody who could teach me to hatch chickens artificially, successfully, to give him fifty dollars.

One day after I had been working for my employer I began to study this machine, and now I get a hatch of from eighty to ninety per cent of the eggs put in the incubator. The only available food we have containing enough protein is wheat bran and alfalfa leaves.

Any man that is in the poultry business should also be in the dairy business for the curd of the skimmed milk is worth five cents a pound, used for feed for the small chicks.

Discussion.

Q. How many eggs do you get from one hen each year?

A. From one hundred and ten to one hundred and thirty.

Q. After the chicks are hatched where do you keep them?

A. They are kept in brooders.

Q. After the chickens are hatched what do you feed them?

A. Cracked wheat and something green if it can be obtained.

Q. What is you net proceeds per year?

A. All the way from one hundred to one hundred and thirty per cent above the cost of keeping.

Q. What do you feed your hens?

A. Curd, bran and shorts in the morning, and in the evening half wheat and half barley.

Advantages of Organization.

By Joseph H. Parry, Salt Lake City, Utah.

Mr. Harris has told you in brief the advantages of a thorough business organization to be carried on and accomplished. Any work in any line of business must be done under organization, and, as was stated, among the poorer organizations of the state, that of horticulture is conceded to be one of the poorest. Horticulture in all its branches, from the production of the trees and fruit to the selling of fruit, has no organizations worthy of the name in the whole state, that I am aware of, although the need has been recognized by all fruit growers throughout the state. Every one is his neighbor's enemy and his brother's enemy, and is afraid to tell even his brother what he is going to do, for fear of his getting ahead and getting the best of him. I have heard where even brothers engaged in fruit growing would not tell one another where he was going to go for fear he might get ahead, and would not tell until they met on some street in some by-town with their wagons. Now, how much better to have made arrangements before going out,—say, you take the west side and I will take the east side of town and we will ask a reasonable price and get it in that way. The conditions are these: For example, we can grow the finest grapes in the world; California cannot equal them, and yet they will take those grapes and peddle them around in their wagons and sell them at the ridiculously low price of three cents per pound and thank you for buying them at that price, while the California product, spoiled at the time it gets here, never sells below six cents. I believe I am right here. We will ask seven, eight, and ten cents per pound after organizing and we could just as well get it, and people will buy our fruit and appreciate it more. My friend, Mr. Farr, (he is somewhat better in the business) gets better prices than the California producer. Now we have not many Mr. Farrs or Mr. Snows in the state. We want to get the wisdom, the benefit and the help of Mr. Farr and Mr. Snow in making the most of our products and in building up a business worthy the name of a business. The only way is by organization. If we organize, our

leaders, Mr. Snow, Mr. Farr, President Judd, and others will associate with us; we will form association with them, their wisdom, intelligence, practical experience, hard knocks in the world will help us. We will all get the benefit of their training and they will show us how.

Now those are some of the advantages, in a business way and we sadly need them. Our apples and our peaches sell on the marekts now for a song. Many of them are not worth that, and many that are good are not bringing what they ought to. We have apples here from Idaho, sold for double the price that our own markets afford our local growers. Now, what is the reason? It is because they are organized. They say, "our stuff is Idaho apples" and they come down here and push out our own apples and sell for double and treble the price that we get. Produce good fruit and good products and then we can have our own market and take a share in outside markets. In every line of horticulture it is the same way. We need to have an organization of strong men who will be alive to the interests of fruit growers of the state. We must look out for markets that will bring in returns for our work. It is one thing to raise the fruit and another thing to sell it. By perseverence and by following proper methods of irrigation, and so on, we can raise the best fruit in the world, but it is another thing to put it on the market. Take Moab for example, isolated it is true, but thousands of bushels of apples, plums, grapes, etc., are wasted every year for want of care and because the people do not know how to put them on the market to bring handsome returns. Moab is celebrated for fine fruit of all kinds; it isn't excelled anywhere accept in Utah's Dixie. Notwithstanding this, there are thousands of pounds wasted there every year and if the people would get together, they could save every particle of it. There are a few enterprising people there but everyone says, "everyone for himself" and those who don't know how to manipulate the transportation part of the business, has an orchard left and strewn with every kind of fruit, the best on earth. Now, they could save all this if they would co-operate and build factories and canneries. That which could not be harvested in a fresh state could be cured and taken care of in that way, and a market found for that as well. Now, that is only one place. You can go through the state and find the same need for organization everywhere.

You will find that in an educational way we cannot limit it in any way because from every side there are great advantages to be gained in an educational way by organization. Take these men, they will give us ideas on culture, varieties and so on and, in this organization an opportunity is given to them, whereby they can educate their less educated brethren, and show them how to raise fruit and put it in a condition to go on the market and bring in returns. If you will raise good fruit, good products, and leave out the market, not half is done. Now the first half must be done. Our state is woefully behind in many methods. Many people, to this day, don't believe in spraying and feel terrible because the law compels them to spray, but the man who knows its value and has practiced it, doesn't need to be told to spray, whether the law compels him or not. You don't have to send the inspector after him to make him cut down the wormy trees. If they come here, they will be converted and we won't have to have policemen to look after the fruit trees to have worms eradicated. But the educational advantages of this organization and others that should be effected in every county and many precincts cannot be estimated, because we can see from every side the education that comes from it, because, in our organization here, we can have meetings the same as in other states and ask professors of the College, and those that have studied these things, to talk on different phases. We can ask Mr. Judd to talk about Dixie, and we can ask Mr. Snow, of Brigham City, to tell us what he knows about peaches, because he is one of the best growers in the state; and we can ask Mr. Farr about raising grapes. Many of us know how to do these things but these men are educated and will give us the benefit of experience, thought and work along these lines, and we will get it here in the organization.

Now, organization will take a little work, a little effort, a little money. We had a little illustration of this up in Ogden. The people all favored organization. The fruit growers held meetings under their auspices for quite a time, and everything went on smoothly until someone spoiled the whole business; someone said it would cost a few cents. The people just spread right out and never came together again. We should have a small initiation fee and the funds will be spent in a just and equitable manner for the benefit of the fruit growers of the state. It isn't to build up some

particular man; in some states these organizations are a power in the land by publication of books and circulars that they sell. Every two years they hold meetings and have a book of the proceedings and so on. The books sell for one dollar each. The state legislatures have appropriated money to help out these societies. Out of this we can grow to be a power in the land. It will take only a few cents, a dollar or two, as the case may be. It will be for the benefit of the people of the state. There is no graft in it. If we cannot raise funds of ourselves, we can ask the legislature to appropriate a few hundred dollars for publications and so on. We can do it if we will, if we are united, if we are interested in building up the horticultural interests in the state. The governor thinks a great deal of it. We can show people the benefits if we are organized. They will come to us and help us.

We need a reform in many ways and the way to have it is to reform. If we ask the legislator individually, he will ask, "who are you?" "Well, I represent a few people here." "Well, come together as a band and then ask for what you want and we will give it to you." Any of those members of the Commercial Club can go to members of the City Council and ask for something and they can get it. They are organized. They want this reform and get it. Why, because they represent in a concrete form, boiled right down the sentiment of the business men of the community and they send Fisher Harris, and the heads of this association get together and say we want this reform and circulate it among the members and they all say we want that. They go to the legislature, or the governor, and state their case; they are listened to and respected in their wishes. We will be respected, even if we have been able to get but twenty members. That is where the power of unity comes in. If we can show anything to be for the benefits of the fruit interests of the state we will get it.

Utah Fruit Markets.

By. Joseph Stanford, Ogden.

For many years, we may say from the time of the completion of the Central Pacific railroad to the Pacific coast, California fruit growers have shipped very largely of the products of their orchards and vineyards to the populous centers of the East, where they have found a ready and profitable market. This same market is, and has been during this long period of time, open to be approached and to receive from Utah the products of her farms and orchards. We must, however, admit that we have been tardy, if not slothful and negligent, in taking advantage of the proffered opportunities; for not until very recently has there been an effort made to place our fruits in any of the cities of the far East, which fruits for variety and quality cannot be excelled, if equalled, by any competing state or territory.

It was only about three years ago that any effort was made to ship in carload lots. All were content with a little local trade shipment to way stations along the lines of railroads centering in Utah. All were looking and expecting our home market to consume the bulk of our products. It may be said that the cultivation and planting of the different varieties on sufficient areas of land were inadequate to meet the demands of the Eastern markets. This is true, and in part is being remedied by the planting of several varieties in sufficient quantities, so that instead of a few hundred cases, carloads can be shipped, and are being shipped, from several localities. As many as twenty-five carload lots have been shipped from one orchard, and over 265 cars from the county of Weber the past season.

No difficulty has been experienced in obtaining access to the Eastern market, for in point of quality, in size and flavor, especially of our peaches, pears, apples and small fruits, Utah fruits cannot be excelled. The reputation of our fruits is being well established in all Eastern markets. Eastern commision men are now looking over the field, anxious to contract for the coming season's crops. Our hold upon the markets, as well as in increasing patronage from them, depends upon the action of shippers, as well as the proprietors of orchards. Special regard must be paid to the

selection of the best and most choice varieties, to care in wrapping and casing, and to prompt shipment in refrigerator cars.

Many people have an idéa that shipping the smallest, poorest kinds, which will not readily sell in the home market, is the proper and most economical and profitable way to do business. This is a fatal mistake. Our canneries, also, should have protection from being imposed on. Inferior, poor fruits and vegetables are too often canned, to the injury of this industry in the markets where these articles of consumption are sold. Frost bitten and rotten tomatoes, in some instances amounting to several tons, the past season, have been imposed upon the proprietors of canneries, by placing an inferior article at the bottom and topping off the cases with good fruit, thus avoiding detection at the time of delivery.

The latter, gentleman, I would say from my information and knowledge obtained in being closely in communication with some canneries in Weber county, I know to be the case. I don't know that this is not partly due to our failing to clear out the canneries of the tomatoes; but suffice it to say, we have many cases and carloads of that product on our hands in our canneries. To my own personal knowledge, also, a few years ago, a good many car-loads reached the Eastern market, probably more at Denver than any other point. In putting them up, the cans had frozen and the fruit had become soured and was returned, to the great injury of our market, and especially so to that industry in Weber County. There were carloads upon carloads returned and spoiled. Now, it is a positive fact that if we want to secure and maintain a prestige and get a market for our produce, whether fresh or canned, the best and choicest kinds should be selected, both for canning and shipping fresh.

We have a great many canneries in Weber County. There are nine or ten or twelve. There is a possibility of some localities over-doing the market, to a certain extent, but I am satisfied that when we get a firm footing in the Eastern markets, as we are gradually doing if we are careful in the selection and quality of the fruits that we send out, instead of a decline in patronage, we will have it considerably increased.

I have been through many large cities, having a residence in Washington a few years ago for one and one-half years, and I can say that ,judging from the fruits on the markets there, from the

adjacent large states I visited, there is nothing produced in the East in the shape of peaches, grapes, and other varieties that will compare with those from the West. The best peaches and grapes on the markets in Washington came from California. In this respect, we can compete and, in fact, in peaches and pears, we can excel California products; and our grapes, it has been tested, leaving out any reference to the southern part of the State, can compete with California. Here in our central counties, we are having great success in grape raising and, in point of quality and flavor, I believe they will compare favorably with any that come from the vineyards of California. Of course, we have not taken into consideration any large acreage of raising grapes until the last few, perhaps five or six, years. In Ogden, to my own personal knowledge, in the vineyards, although they are very limited as far as size is concerned and in quantity, excellent grapes are produced. In Mr. Farr's gardens and also in Mr. Wilson's gardens I have tasted grapes which, in point of quality, flavor, and weight in bunches, I believe will compare favorably with anything produced in California. Attention should be given, as I have before observed, to the selection of the kind and quality.

There has been one great mistake in marketing in the past; that is, that we have been desirous of crowding on foreign markets, by shipping abroad our inferior products, both of the farm and orchard. This is a mistake, and we had better have them perish at home and bring no returns than to ship them East and thus have a tendency to close the markets.

I need to say no more; there are other things to be treated. Some sixteen or eighteen years ago, in Weber county, I was then a Selectman and Judge Shurtliff was Judge at that time—we and our colleagues in the County bought an eighty acre farm and planted out seven and a half acres of large fruit and some small fruit besides. Some four years ago, I was returned to the same position and have occupied that position during the past four years. That farm and orchard have been largely neglected. The small fruits have been so neglected that we had to root them up and replace them with new plants. We also, at that time, planted out five acres more of the choicest fruit trees, largely in peaches. Last year was the first that they began to bear, to any extent, and we had a most excellent crop, large and fine in quality

and flavor, because of the selections made when they were planted some four years ago. We got them from our best local orchards. The previous ones came largely from foreign orchards and, while we planted, distinctly separate from the orchard, one-half acre of cherries, we had not one cherry tree that was good for eating or preserving. They did not come true to the kind that was promised. We have now a few trees of the finest kind of cherries and our peaches are excellent. The largest number of trees planted is in peaches and we have a very excellent variety, large in size and of good quality. Last year we planted another five acres and they, too, are coming along excellently, so that in that farm alone we have something like ninety-seven and a half acres of fruit, and I have been interested, so far as I am connected with this farm, in raising the best and choicest qualities of fruit. I believe this year, if we have anything like a fair yield, we will have several car-loads.

I thank you for your attention.

Discussion.

J. R. Porter: I understood the speaker to say that there are some twelve canneries in Weber County. I would like to ask if he knows if there are any of these canneries, at present, that are going to can gooseberries. I have planted out some in Morgan County and we have a cannery near us there, supposed to use gooseberries, but at present, they hardly think they will be able to. I should like to be in touch with canneries in Weber County, that are nearest to my County, which are canning gooseberries. In my home canneries, I am not getting the encouragement I need. That is what I am interested in, or will be in that line of fruit, and I should like some assistance if I could get it in the way of canning. It will probably soon be on.

Mr. Stanford: In Weber County I don't think any gooseberries are raised, but I can give you the names of canneries canning fruits.

Mr. Wilson: The Wasatch Orchard Company, Mr. Ballantyne is interested in canning in Weber county, probably you could give Mr. Porter some information on that subject.

Mr. Ballantyne: I believe all the factories are going to can fruit but will not be canning early fruit. Two or three are canning nothing but fruit.

Choosing and Planting the Tree.

B. H. Bower, Provo, Utah.

This is a subject that might have been discussed appropriately earlier in the season. Yet, thoughts may be gathered and stored up for future reference.

CHOOSING THE TREE.

This is a very important part of the work of tree planting. "What are we planting for?" is a question to be settled first. Is it for long shipments, local trade, near marekts, or for the home table? When this is decided, then, what is best for the desired end? In considering this question, color, texture, keeping qualities, time of ripening, quality of the product, and the demands of the consumer, must be considered. Then, in order to attain success—that, of course, for what we strive,—the condition of the soil where we intend to plant must be considered. Is the land heavy lowland or bench land? Is the formation beneath the surface clay firm, dense soil or is it of a loose, shaley gravel formation; this is a question worth considering.

Then the conditions as to the circulation of the air must be considered. Is there a breeze from a canyon or through the valley, or does the land lie where the air is almost inactive, such as places we come in contact with where a sort of a cold clammy atmosphere seems to exist? Does the tract to be planted lie close to the mountains, at a good elevation or is it down in the broad valley? These questions must be considered before deciding what branch of horticulture to follow; and, of course, they come under the head, choosing the tree, as we must decide what to plant in kind, before taking up the second part of the work that of choosing the variety.

When the kind to be planted is decided upon, we must, in order to avoid vexation and replanting, carefully choose the tree. The root system should be carefully inspected and studied. If every nurseryman understood his business; loved it; and was con-

scientious, the planter might be relieved of some trouble in making his selection. It is, however, always best to know, either by personal inspection or by the aid of skilled help, that one can trust, that the investment is well placed. Often a tree may appear at first glance to be a finely rooted tree and, yet, upon closer investigation of the root system, prove to be badly at fault, owing to poor circulation, bruised condition or otherwise. It may even be a hard clump, covered by a mass of small fibrous rootlets which will never throw out strong feeders and supports. These should, by no means, be planted if success is to be attained.

As to which is preferable, a good one year tree or a two year tree as grown at the nursery, is a question which I shall open for discussion but in this article I shall not give an opinion.

PLANTING.

All commercial planters should be familiar with the best mode of treatment when planting. I shall state, as the opinion of the author, that all plants should be puddled or watered at planting time, all bruised roots cut smooth; the top back severely; the dirt made firm, leaving it firm below and a loose mulch of earth at the surface.

Discussion.

Hickenlooper: You stated in your paper that all nursery stock should be puddled or put out in water, or water used in planting. Which do you prefer? Don't you prefer both? I would like to bring that out.

Mr. Bower: Conditions would decide that. Personally, in planting, I run water down the row before finishing the soil. In my particular locality, the soil is loose and must be made firm around the tree at the time of planting not a hard packed surface, however. Made firm only with the pressure of the foot, not tramped down.

Mr. Sorensen: Mr. Bower, will you inform the audience as to the best treatment for trees that have been shipped, had accident, or laid in the depot and become dry?

Mr. Bower: I find that the best method under this condition is to bury them entirely beneath the surface and leave them

there for, at least, a week, permitting them to absorb the moisture and swell out. In my estimation, this is the only safe way.

We have all kinds of land in our county, highland, low land, heavy black clay, etc. I have in mind one of our most successful young horticulturalist. He has been in the business only about six years. His orchard is almost all of Gano apples. This man tells me that his trees, up to the sixth year, have made him $5.00 apiece, which I consider a good investment. Another man is talking of putting out some Ben Davis, because of this very thing. his soil is heavy and produces a juicy apple.

Mr. Moore: I know a small orchard, three trees, of Ben Davis apples which for ten years, have not failed to bear a heavy crop and they are in a heavy clay soil. For six months of the year water can be got within six inches of the ground and, any time, you can get it in an ordinary post-hole. Someone said that a tree could not stand in three feet of water. I know that these have borne successfully.

Mr. Berghen: Last fall I visited the orchard referred to by Mr. Sorensen, where the Gano is growing and it is one of the prettiest pictures I ever saw. It is a very black soil and water is two or three feet from the surface. The orchard referred to has been sprayed five times and has been cultivated. The plow had been run through it and weeds stood up to my knees yet it is the only one I ever saw free from codling moth, the only one not affected at all by some worms. The trees had not been pruned, as I thought they should be. They had been left wild, but they had a lovely crop and it was a very pretty orchard.

Mr. Washburn: Will you please explain the difference between the whole root planting and the piece root graft system?

Bower: The question has been discussed much, by many people, for a great many years, but I can speak only from my observations along the lines of my experience from the time that I started. Take the Eastern apple; I doubt very much if there are more than one or two firms in the United States that bud apples. Throughout the summer, they have plenty of work, but in order to give employment to their men during the winter they have to follow the piece wood graft system of propagating the apple. Consequently, nearly all the large nurseries in the East make the piece wood graft system of apple propagation, and in my obser-

vation, there is very little difference; both are strong. There is some difference of opinion as to the longevity of the tree.

Mr. Pansy: I would like to have Mr. Bower explain the planting of trees with crown galls, and the danger from the planting of such trees.

Mr. Bower: Of course, the crown, or root gall, might be mistaken, but at the same time, you should throw out any tree with lumps on, whether it is the crown gall or not. You would not make a mistake. If you come to a lump on a tree throw the tree away. The crown gall is up near the surface, and if you whittle into it, you will find that it is a brown knot with brown soft wood, like a cork. These galls are bound to destroy the tree within a few years.

Mr. Moore: If anybody wants to plant that out, can he not go into a bunch of wild roses and examine them and get acquainted with them?

Professor Ball: No sir; that has no relation to the crown gall. It is caused by an insect and has no relation to the crown gall at all.

Thinning Fruit.

L. Hemmenway.

One of the most essential features of horticulture and one that is neglected most is fruit pruning. Thinning is absolutely necessary if you wish to raise fruit that will command good prices in the market. The orchardist should keep his trees headed in order to pick most of his fruit from the ground, keeping in mind that three or four bushels of first class fruit to the tree is worth more than double of that amount of inferior fruit, and it costs less to handle the same. To make it possible to realize the best results in fruit raising I would suggest that in the spring after the danger of frost is over that many of the fruit spurs on the apple and pear trees be trimmed off, where the trees are heavily laden with blooms, leaving the fruit about six inches apart. Later in the season, the last of June, is the time to thin your fruit, at the same time exterminating the codling moth larvae. At this time the larvae have penetrated the apples, therefore by picking the wormy fruit we do away with the worms to a certain extent. It is advisable to leave but one apple to a spur. By following the above instructions, you destroy most of the first brood of codling moth larvae and you have your trees in such a condition as to cover each apple with the third and fourth spray. Peach trees should be pruned as the apple and pear trees. The small fruit should be picked off. The fruit which is left should not be closer than eight inches. We have here in Utah one of the best countries in the world for fruit raising and if we pay close attention to our fruit thinning our fruit would stand the test in any land.

Afternoon.

Mr. I. M. Elliot: It seems to me that this matter of pruning fruit, the proper time and how much it is to be pruned, is one of the most important things in horticulture in our state or anywhere else. One of the greatest difficulties in the

world with our horticultural people is to get them, when they got fine crops, to take off a part. It is like pulling their eye teeth; yet, one of the most important things we have got. The great trouble in the markets, in this state, is that we have got too much inferior fruit. We have got fruit not fit for market, fruit that wont contend with fruit of other states, and one thing we can do is to have our trees properly pruned, and when they are properly pruned to have the fruit taken off properly when the fruit is forming. Now, gentlemen—you horticulturists of the state—I am not in the business now but was formerly and know something of the importance of pruning fruit and preparing fruit for the market. I have had a little experience in selling fruit in your city here. I find that we have got to contend with other places and states with our fruit and they are shipping it here all the time. Unless we have our fruit in proper condition to meet the market we are going to get left and we should have our trees properly pruned and not have them over-bear too much. Cut them off, take off the fruit so that the fruit we do get will be worth double the amount it would be otherwise. Now we have some varieties of fruit that we know over-bear every year and the result is that it is of no consequence. It is too small. In order to sell fruit well in this market or any other market. we have got to have fair sized fruit that will show off in good shape and unless we prune well and pick off the fruit we cannot have it.

Now, in regard to time of pruning, we differ somewhat, some do. I generally do my pruning in the spring, either in February or March before the sap starts and another time in June when the sap is in full flow. And we ought to look to this matter of cutting off the large limbs, leaving too much exposed to the weather, cutting off large limbs affects them more or less and they should be properly protected.

I merely got up to call attention to these matters and now is the time we have to attend to this. Mr. Hemmenway has given us a good paper; he is one of the most practical men in the county and shows the importance that they should be attended to in the proper time and attended to thoroughly. Don't be afraid to reduce the amount of apples. Let us have quality instead of quantity every time. Get a good display of fruit

and you wont be ashamed then, gentlemen, to contend with Idaho, Oregon or any other state surrounding us. We don't want to have the markets filled with other fruit and ours inferior. It is discouraging to go on the market and see ours inferior. They say, "What is the matter with Utah fruit?" They say it is because we don't take enough care and look after our fruit properly.

Willard C. Berghen: Mr. Chairman, I would like to have explained to these gentlemen the advantage of pruning at different times of the year, whether for wood or for fruit. It would be well to explain that.

Mr. Hemmenway: The best time to prune fruit is about the first of June, and from that to about the 10th or 12th of July. A person gets an orchard loaded with fruit and there is a certain amount that is wormy in this county, probably one-third, one-fourth, or one-tenth. By picking that all off at that time of the year you destroy all of the first crop of codling moth and it is not half so hard to mature a good crop in the fall by pruning at that season of the year.

Last year I made a little estimate as near as I could about the amount of good it did. I had a young man picking; I gave him a dollar a day; they were good sized apples and he picked three or four bushels in a day's work. They increase at about the rate of forty to one, and a man could make an estimate of about how many good sound apples he will save by picking them in the spring. There is another thing; if you have three or four apples in a bunch you have no opportunity to get the spray between the apples. You have more wormy ones than if just one apple was left in each bunch. You leave a good, sound apple and figure on getting about four bushels instead of 10 bushels to the tree and put them on the market and sell them at $1.50 or $1.25 per bushel and if you raise 10 bushels to the tree you have inferior apples and cannot dispose of them at all.

Professor Ball: How many apples do you think a boy would have to pick in a day in order to make wages, that is, how many worms would he have to pick off.

Answer by Mr. Hemmenway: About 15 apples.

Discussion.

Mr. W. Kiddle: I have followed out the lines given this afternoon and I wish to emphasize the necessity of the agricultural bulletins. I have been a student at the Agricultural College by reading, and in following out the instructions derived therefrom. I can testify to the good of our Agricultural College, especially along horticultural lines, because that is what I follow. My orchard is not extensive. One thing I can say conscientiously, I don't think you can find an orchard cleaner than your humble servant's. I have been successful in keeping a clean orchard. I followed the same plan as Mr. Hemmenway—an intelligent plan. I got an intelligent boy; it is hard to get an intelligent one sometimes, at least in some neighborhoods. I am in business here in town most of the time and my wife, by the way, is the man of the work. She looks after things in general on the little farm of six acres and, of the two hundred trees, she is the boss, and the good boy helps her. He is a boy with brains. That is what counts. He does what you tell him. We are picking from our trees not only three bushels, but sometimes five, six and even seven bushels. Not altogether wormy apples, because we do not have a great many. Our orchard is somewhat isolated, consequently not so bad as some orchards; but we pick the shaken or chafed fruit that chafed against the trees. That is the education a boy receives who has been with me three or four years and can see that if the fruit is picked the other fruit will grow to such an extent that it breaks the trees down. I have followed the plan of cutting them back; so that you can pick the fruit with a ladder of four feet, and have them grow stocky. Mr. Hemmenway can corroborate what I say regarding my orchard. I can cultivate up to within four to six inches from the tree. We keep our orchard clean, and I think cleanliness in the orchard will tend to produce good fruit free from worms. I grow quite a bit of fruit and my name is good from people who purchase fruit from me. I guarantee there will not be more than one worm in a bushel of apples. It is said, to the disadvantage of some, that the fruit that is marketed here is something shameful; and until we realize the position we ought to occupy as fruit growers,

we will work under disadvantages. I think the fruit can be kept pretty much free from worms by feeding the shaken and wormy fruit to the pigs. We get rid of it and everything is clean, spick and span, and my orchard is one of the best things I have ever invested in, and I feel like a man when I keep the trees in a proper manner, and I do sincerely hope that our members will look up these reports from the Agricultural College. There is a great deal said against professors. I say that a professor who goes into the orchard and cultivates these things and gives us his experience, to him we should heed. Some say that is book-learning. Well, what is the difference between reading out of a book and a man giving us his experience. Let us follow out the lines they have practiced and I know from practical experience what the results will be.

Mr. Hemmenway: I was down there last year, and thought that probably Mr. Kiddle's fruit would be entirely worthless, there was not an orchard around him, that was not wormy; but his was perfectly clean.

Mr. Kiddle: I pick all the wormy ones that should be picked and then half as many more to thin the fruit.

Q. What do you do with the fruit picked?

A. I feed it, every bit.

Mr. Gregg: Perhaps some of you have read the bulletin of Professor Close of the Agricultural College; in a Brigham City orchard he took a number of fruit trees—I happened to see him and he would leave one tree and not take a peach off: the next he thinned the peaches to two or three inches apart, and next to six inches apart on the tree. He took the row right through. Now some would think when it came to picking, the tree would have the most on that had the least taken off and vice versa, but the trees on which the peaches were thinned to three inches had double the amount of those not thinned at all, and the ones thinned six inches—that was an extreme—were wonderful, bringing the very top prices of the market, but it was a little extreme, the six-inch thinning. Perhaps the four-inch thinning is the proper thing, but to leave all of the peaches on the tree is very detrimental to the tree. It injures in breaking down the tree and it gives a class of fruit not marketable.

Professor Ball: They have discussed the question of destroying the worms by feeding the apples to hogs. Have any of you made experiments to see what per cent of worms you were really feeding in the apples you pick off and what per cent of worms you feed in the apples you pick off the ground; that is the difference in the per cent of worms fed in the apples you pick up off the ground and the ones you pick off the tree.

Samuel Wallace: To answer that, I would say that in my little orchard I picked off from the Ben Davis trees about one bushel, I just picked the wormy ones and found about a peck of these with worms and took it for granted that there must be a worm in nearly every apple picked; then I took some from the ground that had lain there about two days or two days and a half before I gathered them up, and from those I got about a peck and cut open four or five, and I believe in six I found one worm. But by picking them, pretty nearly everyone had a worm in and I think by picking them we can get rid of ninety per cent of the worms. In spraying —I don't use these fine sprays—I get where I can shoot the spray right into the bud and just shoot it in good and strong, and fill the little cups full, and in that way I killed pretty nearly all of the worms in my little orchard.

John P. Sorensen: Now, in regard to thinning, the reason why a peach tree that is thinned is better than the others is this, a great amount of strength or vitality, if you please, goes to form the pits, or stones of the fruit; that takes out lots of strength and you can see yourself that if a little peach tree has two hundred peaches on it and you go to work and pick off a hundred and forty, leaving sixty, then all the strength that has gone into the one hundred and forty pits will go to the fruit and makes it that much better. Now, that is the underlying principle in regard to thinning.

Mr. Snow: Mr. Sorensen's idea is right. I have proved that to my satisfaction. A few years ago I conducted some experiments for the College in thinning clings and other varieties. We thinned for about six years some eight or ten inches apart, some early and some late, and the trees showed the benefit of it several years after the experiments had been conducted.

Grapes.

Varieties and Something About Growing Them.

BY THOMAS JUDD.

I have been asked to talk to you this morning about the grape; the best varieties of grapes, etc. I most cheerfully respond, and hope I may be able to say something that will be of some benefit. I have been more or less interested in this line of work for over forty years.

The success that now attends the growing of grapes in the United States has been achieved only by a vast amount of labor and experience. Some fifty or sixty years ago, when grape growing of any particular amount was introduced into the Eastern States, the Vinifera, or foreign, varieties were used, but after many experiments, it became evident that the moist, damp atmosphere of the Eastern States was not suited to this class of grapes. This being fully demonstrated, experimenters turned to the native, or wild varieties, and through the patient efforts of men like Major John Adlum, who originated the Catawba grapes, and Ephraim Bull, the originator of the Concord, and many others, we have the hardy varieties that are so valuable to states of the east, and which enabled the Chautauqua district, on Lake Erie, to ship 8,000 car loads of grapes and make 1,500,000 gallons of wine in 1904.

In 1849, when the discovery of gold in California drew so many people of all classes to that land, they found the grape of the Vinifera varieties growing almost to perfection. These were brought over from Europe by the early Catholic fathers and planted in that land, which proved so very favorable to their growth and hence made it profitable, and a source of great wealth to the state. After the gold excitement had somewhat subsided and the importance of this industry was fully recognized, a commission was sent over to Europe to gather information on these matters, that the best results might be obtained. Some idea of the tremendous growth made in this industry by California may be understood when

we note the fact that twenty years ago her output of raisins was a few thousand boxes, while the amount produced in 1904 was more than 100,000,000 pounds, besides many thousands of car loads of fresh grapes—as fine as the world can ever produce—and forty million gallons of wine. This showing should encourage the growing of grapes, wherever the climate, soil and other surroundings are suitable.

Still, all has not been fair sailing in the grape industry. It has had its drawbacks. The vineyards of France were devastated by the Phylloxera some years ago, so, also, were many thousand of acres in California. This caused a loss of a great many millions of dollars, but (thanks to the push and energy of those interested in this line of work) we have had introduced the wild, or resistant, stock, on which the Vinifera have been grafted. This class of stock, being almost immune to Phylloxera, has enabled France and California to replace their vineyards and to bring back the share of prosperity that this line of industry has given to those countries. There are also other evils to be counteracted, such as the mildews, black rot, etc., etc., but these can be handled by spraying and proper care.

By the aid of the great varieties of grapes now known, this delicious fruit is grown in all the states of our nation, with the exception of three or four.

This state, with its varied climate, is well suited to the growing of this valuable product. We are bringing into our state about one hundred thousand dollars worth of fresh grapes and raisins per year. As horticulturalists, it is worth our while to give this matter our careful consideration. I fully realize that this line of business is in its infancy, but the work already done in our state has been very encouraging. The exhibits made at the state and other fairs has fully demonstrated our ability to produce not only the hardy varieties, but a choice quality of the Vinifera kinds, consisting of Muscats and Thompson Seedless (for raisins), Flame, Tokay, Black Hamburg, Cornichon, Emperor, Zinfandel, Lady Downing, Mission and many others.

In Washington County (in a small way) we have a California climate of our own. Here can be grown the fig, pomegranate, Vinifera grapes of all varieties, and all kinds of semi-

tropical products. Raisins produced in this section are very choice, and its table grapes are unexcelled.

The growing of grapes, when well cared for, is quite profitable. An acre would contain about 700 vines. These, at five years, should average ten pounds each, or 7,000 lbs. per acre. This, at two cents per pound, would be $140.00. From thirty to forty dollars per acre per year should cover all expenses after a stand is once secured. The business is very pleasant and would furnish employment for all members of the family able to work.

The selection of location is very important. Choose a sunny, warm position of medium sandy or gravely loam. Cold, wet land will not do. Plant only one variety in a row. Don't put out too many varieties. Find out what the market calls for and what you can best produce and stick to them. Don't plant trees among vines; let them have all the sun possible and be very careful not to water too much. Rather, give them an extra cultivation. This will keep the soil loose and warm, ripening the grapes earlier, making them sweeter and helping their flavor. They will also stand handling much better, if they are not made soft by too much water and shade.

Of the hardy, or American, varieties, I should suggest Concord, Niagara, Campbell's Early and Moore's Early. Of the Vinifera, or foreign, varieties, my choice would be Muscats, Thompson Seedless, Black Prince, Black Hamburg, Flame Tokay, and, where the season is of sufficient length, the Cornichon.

I thank you for your attention and trust some good may come from this talk.

Relation of Bees to Horticulture.

By T. R. G. Welch, Morgan, Utah.

Information for Bee Keepers and Horticulturists, Derived from Experience and Investigation, Relating to the Economy of Nature in Plant and Insect Life in their Mutual Inter-Dependence.

In plants and flowers is found what answers to sex in animals. Sometimes both sexes exist in the same flower and sometimes in different flowers of the same plant; sometimes in separate plants. But whatever the plan of growth, fruitfulness depends upon the fertilization or pollination of the pistil by the grains of pollen produced in the stamen. The stigma, or the upper part of the pistil, is a part denuded of the epidermis touched with a vicid (sticky) substance, and when properly developed pollen adheres to this part. The pollen tubes lengthen till they reach the ovaries, which completes fertilizaation and causes fruit to grow.

Pollen and Honey.

Pollen and honey are necessary for the preservation of certain forms of insect life, and the distribution of pollen seems to be essential to the best development of the plants visited by insects. This has been believed for a long time by careful observers, but many farmers and fruit growers have regarded bees of little importance, and some have even classed them as enemies. Honey bees are here referred to because they are the most important of all pollen distributing insects. They appear in greater numbers early in the season than other insects and their great activity renders them more potent in this field of usefulness than any other species. It is now well understood that insects are absolutely necessary to a crop of cucumbers, melons and squashes, and bees are kept for the purpose of pollinating them when no apiary is in the neighborhood.

As a pollen distributor the honey bee is perhaps of greater value to this country than the crop of honey produced. Scientists concede that the honey bees are more beneficial as pollen distributors than all other sources combined and to them we are greatly indebted for both quantity and quality of our fine

fruits; of this there is little doubt. Other insects assist in this work only on a very small scale compared with the honey bee, they being general pollen gatherers wherever pollen is to be found and will thoroughly canvass several miles of territory to find both pollen and honey.

Fruit-growers of the present have awakened to the fact that the honey-bee is their best friend, and that bees and fruit-growing must be closely combined. So it is all along the line of this immense field of labor. We depend upon the honey bee principally for successful returns. Who could not be a friend to the honey bee, one of Nature's gifts to man? That there are not enough bees to supply thoroughly the want there is little doubt; many neighborhoods have but a few colonies of bees. In support of this I would refer you to the State of California, which is the most extensive bee-keeping state in the Union and also the most extensive in the production of fruit.—National Rural.

The number of insect visitors in any orchard determines to a very great extent the amount of cross pollination carried on. The pollen of the pear and apple is not produced in sufficient quantity nor is it of the right consistency to be carried by the wind. The pollination of these trees is therefore dependent on the activity of the insects. Ordinarily there are enough of these to cross pollinate a few hundred trees, but in the case of large commercial orchards, especially where several are in close proximity to each other, there is not a sufficient number of insects for cross pollination when the trees are in the height of bloom. For this reason, each large orchardist should keep a number of colonies of bees.

How it Looks to the Austrians.

"In seven locaities in Austria, last year, experiments on the fertilizing of fruit blossom were conducted according to a concerted plan on a variety of trees and shrubs, choosing those that had not borne much the preceding year. In one locality apple-blossoms covered from insects bloomed one to three days longer than uncovered ones; pear blossoms four to five days longer; and plum blossoms four to six days. No fruit set on the covered apple-boughs, and less on the covered pear and plum boughs than the uncovered ones, much of which fell off prematurely. In another locality the experiment was tried on a pear and a cherry, which bore fruit in abundance

on the uncovered branches. All the covered blossoms remained in bloom longer, but none developed, except one, this apparently because it rubbed against the covering, and this withered without a kernel. In the third locality, two covered apple boughs bloomed three days longer than the others, and no fruit developed, while the uncovered branches bore in abundance. In the other four localities the experiments and results were so similar it is not worth while to mention them particularly. The whole forms a convincing proof that insect aid is necessary to fruit industry."—Bee Keepers' Review.

Bees are also very useful to the horticulturist, as they are able to carry pollen from one flower to another and thus fertilize the flower. As many of our fruits are self sterile, they could not fruit without this help from the bees.

"Careful experiment by entomologists has shown that bees are not guilty of cutting open grapes and other fruits, as their mandibles are too weak and are not designed for such work It is, of course, true that after fruits have been torn open by wasps, birds, etc., the bees feed on the pulp and juice." —Professor Hunter, of Kansas, before the American Nurseryman at Chicago, June 14, 1899.

Discussion.

I. M. Elliot: I will make a few remarks on this question. I think all these subjects ought to be discussed as we go through them. I have had some experience in raising bees in my orchard. I gained this experience when I had a large orchard and a number of bees, some fifty or sixty stands at a time, and I found they worked very well together, and I think it is very important that we have bees, either in our own or our neighbor's, in connection with our fruit growing. No, the pollen these bees carried from one tree to another—everybody knows it is very essential. The bees do that office, that work, and therefore we ought to protect them as much as we can. This subject is so important that we had to have a law passed in the legislature to protect the bees of this State. We all know, any fruit man at least ought to know, that the bees are beneficial, and the idea of a man going out into the orchard when it is in full bloom and when the bees are doing good work, and killing them off by spraying, is

perfectly ridiculous. They ought not for one moment to think of such a thing. It has been done right in our State. People have gone out and sprayed orchards when in full bloom and have killed thousands of bees. I saw in some paper that spraying didn't affect the bees, that the bees were affected by other things and not by the spray poison. We all know better than that. We have had this subject discussed before and we know that sprayings do affect bees more or less when the fruit is in blossom. So I am glad that these two things are coming together—the bee industry and the fruit industry. They are among the most important industries in the State. Look at California; it is a bee state and a fruit state, and the two go hand in hand, and as soon as we understand these things they will go hand in hand in our State. Let us work together in harmony. We all know the bees are friends of our fruit growers as well as the friends of our families. I am very glad that the matter has come up for discussion in this meeting, the bee in connection with our horticulture.

Mr. Snow: I am very much in favor of the trees but I would like to have Mr. Welch tell if he has had any experience with Pear Blight and if the bees don't really carry Pear Blight in the blossoms.

Mr. Welch: So far as I know, flies, instead of bees, carry the Pear Blight. You can't blame the bees for it; the flies carry it while the blight is on the tree and the tree is in bloom. During the whole summer while that blight is on the tree flies will visit it and carry it around.

Mr. W. H. Miller: I have had the same experience with Pear Blight and the last summer I had quite a tussle with it. I have found on that point, the Bartlet pear after the blossoms had all fallen, a white sore of juice or sap came oozing out wherever the blight struck it. Bees and varieties of wasps I have found on this. They would carry this all around. Now, they carry that more or less to adjoining orchards and destroy quite a number of those trees. My experience is that the Pear Blight doesn't spread in summer pears like it does in the winter pears.

Mr. Broby: Visiting the different orchards of Cache Valley (I am inspector there) I found that a number of beekeepers have orchards there and I don't find the blight any

worse there than in any other place. For that reason, I don't believe the bees are any detriment to the fruit growers, because there are no more there, where they have many bees, than where they have none.

Mr. Kartchner: Some think the reason for blight is that the tree is hide-bound and that ripping the bark will cure it.

Mr. Welch: In relation to the question, to the statement of the gentlemen from Cache Valley as to the close proximity of bees to the orchards, I visited an orchard last week where there were some twenty pear trees among the apple trees. They would average in thickness about the size of a man's thigh, and the bark of the tree near the roots on every tree found alive was perfectly dead and nearly all the foliage that was on those trees was dead brown. I have bees right in my garden and have three or four pear trees for my own use, and there were only two or three limbs affected at all by the blight while on the lot adjoining me there were two large trees perfectly covered with dead leaves. I don't know why mine should not have been badly affected too if bees carry the disease.

Mr. E. S. Lovesey: I have had some little experience on the bee question, and many people have told me, in fact Professor Cook, who originated this spraying system, told me that by tying the limbs up on the trees, putting on mosquito bar, thus shutting up portions of the tree, materially affecting that fruit to the advantage of the balance of the tree. One of our speakers mentioned a clause in our law that would prevent the killing of bees. I hope that fruit growers through out the State will honor that law. If we don't, we expect that the spraying will kill off our bees. In this county the bee question has been a pretty serious one but we are in some hopes of getting a little redress from the smelter people. We have imported bees into this country for several years and I believe the fruit growers are more or less indebted to us for importing them. And, while in many instances we have got good crops of honey, the bees have all died off in August and September through the effects of the smelter smoke. I find that bees inhale smoke and die that way much more than they do from gathering poison from the blossoms. Last year I had bees in three or four different sections of the county and in September they died off rapidly, nearly all

died. I gathered them up and took them out to Pleasant Green, where the wind keeps the smoke away. I gathered them up and took them out there and wintered them out there, and they did well on the same honey that I gathered from the smoky district the year previous. I would like to ask our fruit growers if the smelter smoke injures the fruit. I know it injures the trees. Does it injure the fruit in quality or quantity?

Mr. Hickenlooper: As my name has been called for along this line of Pear Blight, I will say that I don't believe that the bees are responsible for as much damage as they get blamed for. I have been operating a large orchard in Bear River Valley the past three years, and I believe that place gets credit for having the first Pear Blight in the State, and we noticed that it spread and came this way and reached Weber County three years ago this coming summer, and it spread very rapidly over that county. Since then it has been coming this way. I notice that in the north part of the Bear River Valley where few bees are kept and some localities where there are no bees kept, it just breaks out spontaneously in the county. Mr. Roach has about a forty-acre orchard, and it was just growing lovely, making a splendid growth, and all at once it was struck by this disease and you would have thought that a fire had swept through there. I did not believe that it was through bees that this was done. It was late in the season when it happened. In regard to bees being poisoned, I will say that if you are spraying for codling moth you are too early and you might just as well not do it. The spraying for codling moth should not be done until the apple is just formed. Get your poison into the calix and it will become enclosed. The man who sprays his trees when in full bloom is throwing poison away. Is that not correct? That is my experience and I see no reason for beekeepers and fruit growers coming in contact along these lines.

Mr. S. D. Moore: I would like to ask the question of those who have had experience with Pear Blight if they believe that the bees carried it from the bloom or from the exudation of the outside of the bark.

Mr. Welch: My experience was that the bees carried it from the sap.

Mr. Moore: I have noticed that the Pear Blight begins

from the branches that had no blossoms on them. I don't know what the condition is in other parts of the country, but in the part of the country I came from the thriftiest trees are those that are affected with this disease. It was so in my orchard. I have a tree that exudes on the bark and when our birds of various kinds light in the top of a tree they get their feet covered with the secretion and fly to another tree; and I am inclined, while I am a lover of birds, to believe that in this way they may be distributors of this poison because it is something that kills. 'It killed my trees and my neighbor's trees, and I believe that in accordance with the theory I have had, the blight begins where the bird is most apt to light and not where the bee is apt to go at all.

Mr. Kiddle: I have had some experience with the Pear Blight and I am of the opinion, based on my observation and experience, that it comes on the most thrifty trees. I couldn't for a moment in my orchard (by the way I have quite a number) say that the trees are hidebound. I found it invariaby on trees that were thriftiest growers, and as to the ripping of the tree and driving nails into the tree and all such superstitions (possibly we might class them as superstitions), I don't agree with it myself. I know the Agricultural College professors talk against the driving of nails or ripping of trees. I find in my orchard, where I have numerous varieties, that I have a pear called the Peasant Russet. The Peasant Russet has been a thrifty grower and it is attacked as much as any of thĕm. It is a very beautiful pear and keeps beautifully. The Sheldon has had the pear blight; the Bureau Anjon has been entirely free. I have quite a number of the last named variety and I don't find the disease at all among them. They are quite a thrifty pear and if the bees carried it there is a scruple somewhere. My experience doesn't justify me in believing that the bees carry it entirely. Another thing, pear blight didn't occur in the tops of the trees. That is somewhat different from what I have heard. Some attacks were within two feet of the ground. All the top of the tree looked beautifu. I simply went to work. I took the tree right out and burned it up. And I believe that is the only way to get rid of it. It have cut out limbs in full health and loaded with fruit. Disinfect the saws you cut it out with and nothing can remain of bacteria.

A Few Facts About Peaches.

By A. H. Snow, Brigham, Utah.

I thought in the short talk I would give you this morning, it would, perhaps, be more interesting and more profitable to you to give you some of my own experience; that, after all, is the most valuable, especially along the lines of horticulture.

When I was a boy a few years old, my father at Brigham City used to have about a three-acre orchard, and he took considerable interest in planting flowers around the orchard. We didn't have the varieties of fruit that we have now. They used to have seedlings, but some of those used to be pretty good. It somehow or other fell to my lot to do the irrigating. I remember what difficulty I had in watering when the chickens filled the ditches up with dirt, but somehow I took a liking to it. In grafting and budding, some way or other, the foundation of my interest in horticulture was laid. I do think that, although father left me no money, it was in my love for the earth and horticulture that my foundation for life was laid. I have been living in Salt Lake, but in the spring I am almost crazy to see the soil. I like to see the buds spring out. While, perhaps, I have made a little more money in Salt Lake, I don't take the comfort from it that I do from horticulture and from the soil.

Now, in my thirty-one acres in Brigham City, in selecting the soil, I selected three tracts of land: One tract faces the north, another west and the third slopes to the south. My rand is all of a gravelly nature and it is not what you call very rich soil, that is, generally speaking. I remember when Mr. White from Ogden passed along the road and said, "I cannot see for the life of me how you can raise peaches on this soil." It is all gravel and rocks, but the peaches do well just the same. I selected land near a place where I could get the drainage (we don't have any too much water.) When my orchard was young, I found a variation of from ten to twelve degrees in temperature in the upper and lower parts of it. I found that the tops of the peach trees were frozen back six

inches in the lower parts, and in the upper part one inch, showing that frost runs down hill. So I selected the upper soil for my peach orchard and the lower soil for the apples.

In putting out my orchard, I put sixty per cent of Elberta peaches and forty per cent of other varieties, varying from early to late. I put out some Geo. A. Lowes. We find Fosters come in about the 20th of August. Ogden doesn't find this variety so good. We find the Fosters a splendid yellow peach. We don't have to assort them; they grow about the same size. They thin themselves. After the Fosters are gone, according to the market, then come the Elberta. In one year I planted 3,000 Elberta trees. I planted them by marking out the field in proper rows sixteen feet apart, planting the trees in furrows. One man can plant about three hundred a day. I selected home grown trees. I selected trees a year old for the stone variety. The year I planted them, the loss was two per cent.

We practice clean cultivation. We allow no weeds to grow. I have a good cultivator and a disk harrow, which is very valuable, and I cultivate both ways. We cultivate, of course, after every storm, so as to hold the moisture. We cultivate once every ten days during the whole season while the trees are young; keep the ground free from weeds, and the trees grow very rapidly. When the Elbertas were three years old they produced six car loads of peaches, mostly off of the 3,000 trees.

I paid $93 per acre for the land and water-right—I am speaking now of my main orchard of twenty-five acres. Since that time I have lived to see the water-right itself go up to $200.00 per acre, and the land and water-right to $250.00 to $300.00 per acre. I am satisfied that the horticulturists do not appreciate their opportunities.

I went to California after my orchard was about two years old, to look after methods of handling fruit, and there I took photographs and made examinations of the manner of packing. I was down in Santa Clara County, below San Francisco about sixty miles. They appreciate the value of the land. I said to a man, "What is your land worth here?" He said, $600.00 per acre." "What is it worth to you in fruit?" and he said, "$1300.00 per acre." They simply price land for what it

produces. Now, the rate from California to the East is $1.25 per 100 lbs. on fruit; from here it is only $1. They have 1,000 miles farther to ship. They have to pick peaches as hard as rocks, about two days earlier than we do here, so that when they get East they are not as good flavored as those we have. I believe our land will be as valuable as the California land in a few years.

About trimming I want to say just a few words. As you know, the peach is a rank grower and you have to cut it back. I cut mine back about one-half every year. In California they take more pains than we do; they cut them back from one-half to two-thirds, almost every limb; and every small limb is cut back. I don't do that; I cut mine back at the top but I can't quite take the pains that they do in California. Of course, the young trees can be kept back. I know that here, about two years ago, we had a very severe snow storm; the peaches were not quite gone. I never had one tree injured, and they were very heavy with peaches. When the snow came it bore them down but it did not break them. Other people who did not do this lost as many as eight or ten trees on one acre, just on that account. When we cut back, new limbs will grow and you get more bearing and fresher surfaces so that the trees will last longer. Some trees have to be taken up in twelve or fourteen years, and some that are kept cut back last twenty-two years.

Before they start to bear, they don't want so much irrigating. When they get to bearing, we irrigate once a week. The water runs off easy. Our soil is loose and the water runs off, but it would not be that way on all soils. We find that the peach swells rapidly the last two weeks before ripening, and unless you have water you don't get the result that you otherwise would.

Well, when I went to California I studied the methods of packing, of putting them into boxes. The man I was with had six or seven wells and pumped the water out of the wells, 600 feet deep, for the orchard. His place is worth about $1,500 per acre. He had 500 men working on it, billing and shipping and so forth; and he had Chinamen that did his packing. He said they were expert packers. When they get through the

peaches look as though they were moulded. We cannot do it here. We cannot get girls to stay long enough to learn how. They get married off and other girls come on. But the Chinaman can do it. You don't have to watch him all the time like you do a white man. There, they would have the white man carry the peaches to the Chinamen, because they could not depend on them to do the packing. He showed me a Chinese boy that was working and I noticed one peach slightly defective that he threw out. If that had been one of my girls, she would have packed it. We have a little trouble, of course, in getting our peaches packed just right, but in time, this can probably be overcome.

I have a packing house in the center of my orchard and from July to September and during the shipping season, I had from forty-five to sixty-five hands in my orchard. It takes about twenty-two girls to do the wrapping. In thinning fruit, we don't have to thin the Elbertas, they thin themselves. They produce about 500 peaches on a well grown tree. There are other varieties that have to be thinned. I have some that come on just after the Elbertas which are not so regular, some larger and some smaller. I have the smartest girls of our force assort these and give them to the wrappers and they wrap them up. If we get some intelligent girls to assort them, we get them assorted right and then we get them wrapped about right. My fruit runs from about eighty to eighty-five peaches to the box. We have what we call the California pack. We don't run them straight across in rows and then other rows on top. I went to Chicago and found out how they sell our Utah peaches. They told me about California packing. We take a box and put in three peaches and leave a space and then four peaches and on top when we get a layer we begin and put one peach in the corner and one peach rests on three or four peaches instead of on one.

They sell them on the auction market. The auction market is filled with two or three hundred buyers and before they come into this room they go along the platform and examine the peaches, piled up in 50 to 100 boxes to the pile. Each man will mark on his book what he expects to bid for them: $1.10 for this box and another will mark 90 cents and so forth. They come into the auction room and the peaches

are auctioned off. One man says 90 cents, another 92 cents, 95 cents, and so on until they are sold. They will start in again at 85 for the next row perhaps. They sell a car-load in about five minutes. So you see the necessity of having them well packed. They take them indiscriminately, and if they are packed well, a good price is obtained, and if poorly packed a poor price. They are sold strictly on their merits there.

My time is rapidly passing. I have only a few minutes, but I wish to speak of shipping from my orchard. I have not shipped very many apples, as I have a steam evaporator. We have some cherries, but that is not my subject. I have been shipping out from about 15 1-2 acres. I shipped in one car 1,260 boxes which brought $478.80 per car. I have been selling to the same company for some years. I sold them about eleven or twelve car-loads, for $478.80 per car. On the 7th of September I shipped two car-loads, 1231 boxes in each. They paid the same price on the 8th and on the 9th I shipped two cars at the same price. I shipped cars on the 12th, 13th, 15th, 16th. We have to get a move on us to ship two cars per day. You can run it up yourself, I sold a car locally, making 12 car-loads in all, at $478 per car, between five and six thousand dollars for the product, but, of course, we had to buy a whole car-load of boxes at about five and a half cents each. We get them cheaper by having them come in car lots.

I am not on the orchard now. I have some good men there and give them one-half for looking after it. One man has been there nine years. They make about $100.00 a month for their work. This nets me about $2,200 on sixteen acres. You folks can go and do that same thing if you have the soil and look after them carefully. Mine has made me about forty per cent on my investment. Men say, "I don't believe there is so much about farming to be cleared after all." I have given you the exact figures; you know about as much as I do now about it. I am satisfied that the people of this state do not yet understand fully what mines of wealth we have here. They don't understand the advantages we have. After looking it up, going East and West, I think more favorably of the situation. now, but I don't believe many of us know the possibilities we have in this State. I believe, however, if the proper

organizations are made that we will realize the possibilities later.

I thank you for your attention.

Discussion.

Mr Snow: Mr. Judd stated that it is foolish for us to raise grain on our good land. I saw a gentleman in California, and when I went to his barn I saw some nice lucern there. I said, "Where do you raise this lucern?" He said, "Oh, I raise fruit. the other fools raise lucern."

Mr. Sorensen to Snow: Have you got a peach twig borer, fruit borer, and what about it? What do you do with it?

Mr. Snow: We are not troubled with it much now. I have been troubled. We treated with kerosense emulsion and we were somewhat successful. We are not troubled very much with flat headed borers, but when we find gum exuding, we take a copper wire and kill them. We have not had one tree killed with them; but there would probably be a dozen or so slightly injured.

Thomas Judd: Do you find any difference in the north and west side?

Mr. Snow: I find that the south slope is worse because it is too far advanced in the spring, and early frosts may take it. We have not had a complete failure from frost, but we have been hurt some. The north slope is the best. The sun doesn't strike the roots so direcly and the buds are kept back. I have never had the slightest injury on the north slope in seven, eight, nine or ten years. I would prefer the north to the east or west side. I would prefer the north first, then east, then west, and last of all a south slope.

Mr. Weir, Provo: I would like to ask the question as to what soil you would prefer for peaches.

San Jose Scale.

By C. A. Hickenlooper, Ogden.

I assure you that I feel as though I owe you an apology for not preparing a paper. While I studied up the subject of San Jose Scale moderately well four or five years ago, I have not been engaged along that line for something over three years. Consequently, I am quite rusty on the subject, and until the last day or two haven't had any literature with which to refresh my memory; and since then my time has been so occupied that I have not had time to prepare a paper.

I will endeavor to make a short extemporaneous talk, if you will bear with me, on that important subject. I was acting as fruit tree inspector for Weber County in the fall of 1899, when the scale was first discovered in that county, and I think this was the first to be discovered in the state. My attention being called to something of an unusual nature by the owner of an orchard, I hastened to make an investigation. I at once concluded that it must be the dreaded San Jose Scale, and took samples to J. A. Wright, who was then Secretary of the State Board of Horticulture. These samples he immediately sent to our Agricultural College, to Washington, D. C., and to California, for identification. We soon received reports from the same, to the effect that it was a well developed case of the San Jose Scale. We then commenced a crusade against the insect.

Now, in discussing the life and habits of this pest, I will treat the female under three heads: First, active stage; second, growth, and third, reproductive stage. Differing from almost all other fruit pests, this one has no egg period in which to fight it; but is born a very active creature, ready for business from the start. The first few hours of its life are spent in running up and down the limbs and twigs and over the fruit, seeking for a suitable place to permanently locate. It is at this period that the insect is carried from tree to tree by sudden gusts of wind, by birds, and also by bees, moths, and other large insects. It is sometimes carried a considerable

distance in those ways. At this stage, it is almost microscopic. It has eight legs and resembles the little red spider or brown mite, except that it is a bright orange color. It usually locates within eight or ten hours after birth. By inserting its little beak, it feeds on the sap. Within a few hours after feeding, a liquid oozes out of two little tubes in its back and gradually spreads until it forms a complete house or cell over it, which acts as a protection. From this period, it requires a very strong solution to penetrate the cell and destroy the insect.

The female being now permanently located, has no further uses for legs, and these appendages are gradually absorbed and disappear. In about thirty days she begins to reproduce young very rapidly; one author claims at the rate of eight per day.

In this climate, those that are fully matured at the close of the season do not survive our long winters, but those that are left over are the ones that were not fully matured in the fall. In the spring of the year the young usually make their appearance about May 20th.

In mid-winter I once placed a limb containing scale in my office at about 60 degrees 65 minutes, and in a few days I found that they began reproducing, which convinced me that it is only a matter of temperature in the production of scale.

At a certain stage in the life of the male, it is provided with wings so that it can move from place to place.

TREATMENT.

The most successful method of treating scale, that I know of, is the lime and sulphur solution. It is of a very caustic nature and seems to penetrate through the shell and kill all insects with which it comes in contact.

The kerosene emulsion, double strength, will do the work, but it is much more expensive. In preparing a tree for treatment, it should be severely top-pruned, so that one can get at it successfully, and if it is an old apple tree, it is necessary to thoroughly scrape the old rough bark. But this makes it very expensive and is not practical, and only on special occasions, when one has a tree that is very choice, I would recommend saving the tree.

I tried an experiment in a peach orchard that was about eight years of age. It was badly affected with this insect. In August I top-pruned, then gave it a thorough spraying of kerosene emulsion, double strength. Late in the fall, when all the foliage was off, I followed by a thorough spraying of lime-sulphur solution. Shortly after this, a committee, consisting of President Judd, Secretary J. A. Wright of the State Board of Horticulture, and other fruit growers, made a thorough examination of said orchard and pronounced it a grand success. A number of fruit growers have coped with this insect, which convinces me that it can be handled by intelligent spraying.

NATURAL ENEMIES.

I have noticed that the natural enemies of this insect are rapidly increasing in the infected districts; such as the lady-bug, which you are all familiar with, and the larva of the lace-winged fly. This little insect is lizard shaped, with a snout resembling that of the ant eater. This snout is used to lift the scale, which is dispatched without ceremony. It is surprising how rapidly either of these insects will destroy the San Jose Scale.

Mr. Snow: Where is the scale found?

Mr. Hickenlooper: It has been found only in two counties that I know of, that is Weber and Utah.

Mr. Wilson: I understand that there are some in Sevier County and also in Salt Lake County.

Mr. Sorensen: They always manage to find the place till the inspector goes.

Mr. Stanford: What effect does it have on the fruit?

Mr. Hickenlooper: That is a point I am glad you brought up. Where it attacks the fruit when it is small, it usually stops the growth and, in some instances, seems to sap the life until the fruit becomes woody, cracks open and looks very repulsive.

Mr. Beasley: Does it not have a dark spot?

Mr. Hickenlooper: Yes, a kind of a purplish color.

Mr. Beasley: You speak of the lady-bug being nearly as good as the spraying. Won't the lady-bug be destroyed by the spraying?

Mr. Hickenlooper: No, I don't think the spraying would affect the lady-bug in the winter, would it, Professor Ball?

Professor Ball: Not very frequently; they are usually somewhere else at that season. It is also protected by those hard wings.

Mr. Moore: I should like to ask if you have tried lye in connection with sulphur?

Mr. Hickenlooper: Yes, sir; but I could notice no difference; the other is plenty strong enough to kill the scale.

Mr. Moore: My reason for asking is that in our part of the country, a man imported sheep from Canada, and they were covered with sheep ticks, and the solution used did not have the desired effect. He added a strong solution of tobacco and lye and killed the ticks.

Mr. Hickenlooper: I will guarantee that the lime-sulphur solution will kill the scale if it is properly made; that is, all that it comes in contact with.

Mr. Duffin: Does the scale attack all kinds of fruit trees or just certain kinds?

Mr. Hickenlooper: I have found the scale working on all kinds of fruit that are in this locality, except the apricot. I have never found them working on that tree; have you, Professor Ball?

Professor Ball: No; but I would not want to say that they don't work on it.

Mr. Hickenlooper: The reason, I suppose, is that the apricot has a very tough bark; but I have examined trees that were near a badly affected one, and have failed to find scale on the apricot.

Mr. Beasley: How is the scale carried from one place to another?

Mr. Hickenlooper: By nursery stock; for instance, a few years ago there was a nursery in Delaware that became infested with this insect, and it had got pretty well over the nursery before they discovered it. I understand that the proprietors came to the conclusion that if they had to lose that stock it would break them up in business and they made up their minds that they would let the public shoulder the losses. They cut the prices in two, and the result was that they got a great many orders and soon began shipping in

every direction. You can readily see how anything like that would spread it very rapidly, and, by the way, we have very good reasons for believing that our very vigorous stock came from that nursery. Now, had that nursery understood fumigating, all this trouble would have been averted, for there is no animal life that will withstand it. That is the reason why we insist that all nursery stock be fumigated.

Mr. Snow: Does it affect any class more than othres?

Mr. Hickenlooper: Severe on the peach, prune, pear and apple; but I believe that it will kill the peach in less time than any other tree I know of, as it causes its sap to ooze out where it punctures the bark.

Inspection in Horticulture and What it Should Be.

By J. P. Sorensen, Salt Lake City.

I. The Inspector, and what sort of man should he be:

The Inspector should know all the common diseases of trees and fruits, and the simplest and most effective remedies for such diseases. He should be able to mix and prepare the different formulas, and by actual work show any man who desires the knowledge how to do it. He should also be able to explain what each formula is good for and what will be the result of its use.

He should be an enthusiast in his work, not one that always looks at the clock to see if it is five o'clock and time to go home, but one that if it happens to be seven p. m., and there is another orchard in the district to be examined, he will examine it and not waste another day to go several miles to finish an hour's work.

He should be agreeable in his work and pleasant to the public, but firm in the discharge of his duties whether to friends or strangers, always remembering that he is a servant of the public and that he is paid for his work as such.

He should not pretend to knowledge which he doesn't possess. It is not a shame to say, "I don't know, but I will try to find out;" but it is a shame to pretend to know for a certainty what a man only guesses at, and guesses at poorly. If an inspector doesn't know a disease, if he knows his A. B. C's. of inspection, he can as a rule refer any disease to one of three classes, each of which is more or less curable.

I. To all insects that bite, use arsenical poison, Paris Green or White Arsenic.

II. To all classes of insects that suck, use kerosene emulsion.

III. To all diseases, that neither have signs of biting insects, and no sucking ones to be found on trees or leaves of the tree and which trees are still out of order, use bluestone water and lime called Bordeaux mixture.

There are a few more diseases where you must use the

axe or saw and torch, such as Pear Blight, Crown Gall, Peach Yellow, and Rosette. The same thing should be done to all dead trees. No spraying will do them any good. To spray in such cases is only a waste of valuable time. See also that all old trees preserved only for shade, but which in reality are pest breeding nests, are rooted out or cleaned.

Next: For inspection, a reasonable degree of time had better be taken to go over the orchard instead of rushing from one to another seeing nothing and doing nothing except saying "Good day" and "Good bye." On the other hand, don't waste valuable time in idle gossip. It is well to be friendly with owners of orchards, but it is not well to spend a half day looking at the animals.

Remember you are a horticulturist and a fruit tree inspector, not an animal inspector. You most likely know something of the first, and nothing of the latter, and would be only wasting your time to talk about horses or pigs. An old saying is "Shoemaker, stick to your last," and I would say, "Inspector, stick to your work."

If you are a county inspector or if you have nurseries in your district, go over each nursery every two or three weeks in the summer time. On such a visit you need not always go up one row and down the next, but simply cut across in every direction. But once, in the middle of the summer, go over each nursery, row after row, especially if indication points to diseases. In the fall and spring time when trees are being dug up and delivered or shipped, visit every nursery as often as possible, every day or two if you can reach it, and especially look on the roots for Crown Gall and Wooly Aphis. See that trees are cyanided according to law, and remember that all diseases except the apple worm have come to us through nursery stock or through the importation of the same, wherefore it should be well looked after and watched very closely to prevent the introduction and spread of any more diseases.

Under the old law it has been more of a campaign of education than of real inspection, but all who are interested in trees, and willing to learn how to take care of them must know by this time that spraying and cleaning an orchard are absolutely needed, if good results are to be realized. The time has now come when we must make a desperate effort

to clean the country. We have now got a law and such remedies that we must expect reasonably good results from the use and enforcement of the same, and we intend to make a strong and united effort to that end.

Now in inspection a man should act somewhat similar to a good bill collector. The first time he calls he should be nice and mild and smooth, but should give the owner to understand that the law must be complied with, as a matter of course, and that he expects the fruit grower to do so. In a week call again, and if the work is done, make a note in the stub of your book to that effect; if not, see the owner and tell him plainly that if the work is not done in say five or ten days, the case will be reported to the county attorney and he can expect a visit from the sheriff. Tell all this without any "Ifs" and "Ands," and in such a way that the owner knows that it means business. Then carry out your program to the letter. Don't discriminate, but start with the richest and most obstinate customers you find in your district, make an eample of them and you won't have much trouble with the enforcement of the law.

Now to recapitulate:

I. An inspector must watch the nurseries and see that they are kept clean.

II. He must endeavor to have apple trees sprayed with Paris Green or other arsenical spray as soon as the blossoms fall and prior to the closing of the calyx, and he should thoroughly impress on the owners of orchards in his district that whenever the opportunity for spraying is gone it is gone for that season.

III. He must watch the Pear Blight and get owners to do likewise and cut it out as fast as it appears.

IV. He must teach and show people about Peach Borers, and have them attended to in season, likewise with Peach Twig Borers.

V. He must encourage and explain the winter spraying in fall and early spring before buds burst, to keep in check red spider, fungus, and aphis.

VI. He must do his best to get the Woolly Aphis controlled and for this purpose nothing is so important as to get old apple trees rooted out and burned root and branch, as that

will also help to control the Codling Moth larvae. Also clean out and burn all half dead trees of any kind.

VII. Any extra choice fruit-bearing trees which he may come across should be noted in a record for the express purpose of recommending them to nurserymen in order that buds and grafts may be procured from which the stock may be improved. He should also keep a record of all his other work and see that his deputies do the same.

VIII. If he is county inspector he must see that these points are clear to his deputies and strongly impressed on their minds.

These are some of my ideas in regard to what an inspector should be. There are one or two more I have noted down I would like to tell a little about. I always hold that no man can teach others what he doesn't know himself, whether it is in inspection, science, religion, or anything else. Therefore it is necessary for him to be posted in order to know what he is talking about and as an inspector is continually consulted by people whom he travels among, not only ought he to know what to do for different insects but what trees to plant and what time is the most profitable. He should be very cautious becauses we have got too many fakes already. The older ones of you remember well that some eight or ten years ago it was very highly recommended to plant prunes and a lot of them got prunes and they have got prunes more than they want. We have got an instance right here—Mr. Porter. He is inquiring where to get a market for gooseberries. If they had been raspberries he would not have to hunt to find a market. So it is necessary to learn what is most needed and then stick to that. Now, I am very pleased to see these things handled so well, the peach question and the grape question, but so far as you are concerned in Salt Lake you need not bother about this. Here where there is peach land, there is no water. The water was taken up for the low lands before the high lands were taken, and the high lands and bench land haven't the water. We have got plenty down in the lower country. As for grapes, I don't know. We have got one vineyard. I don't expect it to be of much account. One thing is certain, there is a good field here for apples, and I am sorry some apple man has not been selected to talk about apples. A

man out here makes more out of apples than the ordinary man makes out of his land. I am not an apple man, not even in the apple business. I will have to go in for something else. But I am really pleased to think that we had the peach question so well handled. We have got some land here in Salt Lake County that will make good peach orchards because we will get more water from Utah Lake.

Mr. Porter: I would like to know how much confidence you would have us place in tree agents. (Applause.) I bought 100 prune trees on the recommendation of Mr. Sorensen. (Laughter.)

Mr. Sorensen: Well, I will answer this—we had a very strong endorsement a few years ago among some of our leading fruit raisers and especially the highest ones in authority said that the prunes would be such a very great thing for this State and county that I believed it. I had already become doubtful before I recommended them, but I thought they were good, so I recommended them. Now, in planting trees there is such a difference between Salt Lake Valley, Cache Valley. Morgan Valley, Summit Valley and Wasatch Valley that the trees that are profitable here will not be very profitable there and those varieties that are good in one place will not be in another. I have gone through the country as a peddler. I am not ashamed of my business. In Wasatch County there are only two apples that will grow. When you get down a little lower other varieties are good and so on.

Mr. Washburn: Is there any use in spraying an orchard unless it is thoroughly pruned and cleaned of weeds and sweet clover. As the condition exists in many towns, is it of any use to spray until the orchard is thoroughly cleaned up underneath and pruned properly?

Mr. Sorensen: I will answer that straight. There was an orchard south of here. One man did the spraying and another man the weeding. The weeds were high and they were let go. We sprayed five times and through that many sprayings we got about sixty per cent of apples free from worms so you see even with the weeds the spraying will do some good but if you will cultivate and clean as you should it will be a great deal better.

Mr. Porter: I would like to say just a word; I wish to say

I don't feel hard towards Mr. Sorensen. I proved the matter properly. To me it is alright; I have dealt with the College now for some time and if they fail I am going to quit the business.

Mr. Washburn: We are troubled with the tent caterpillar, where I live. Could you suggest a way to kill them?

Mr. Sorensen: The best way is, when you see them coming along get rags saturated with coal oil and give them a touch. That is simple. Arsenic will kill them but this is more difficult.

Mr. Moore: Isn't the caterpillar one of those sap sucking insects, which as long as it doesn't eat it will not hurt the tree?

Professor Ball: Mr. Sorensen is probably alright where just a few tent caterpillars are bothering but in the case of Mr. Washburn, you couldn't burn the caterpillars without burning the tree out. The only way in this case is to burn them just as soon as the leaves start on the trees, just the time the caterpillar starts out; but the spraying after the blossoms have fallen will do it anyway. You have got him.

Mr. Wilson: Speaking about tent caterpillars, two years ago in the county there wasn't a tree that didn't have a caterpillar. The people that lived on Twelfth Street, however, that sprayed had very few caterpillars. Mr. Sorensen's, across the street, took all the leaves and the ground seemed alive with millions of them. We got to work and sprayed the caterpillars when the apples were already forming. We entirely killed them.

Mr. Washburn: This is of vital impotance to Sevier County. Many people to prevent the caterpillar from coming from one man's orchard to another cover their trees with wagon dope.

UTAH EXHIBIT AT THE NATIONAL IRRIGATION CONGRESS AT BOISE, IDAHO, SEPTEMBER, 1906.

(5)

ANNUAL NUMBER NINE.

Utah State Farmers' Institutes

FOR THE

Year ending June 30, 1906.

Published by the Agricultural College, Logan Utah

The Deseret News
Salt Lake City
Utah

ANNUAL NUMBER NINE

Utah State Farmers' Institutes.

PREFACE.

State farmers' institutes have been held annually in Utah since 1896. In that year the legislature passed an Act placing the management of this work with the Agricultural College and appropriating $1,500 to pay necessary traveling expenses and the printing of an annual report. During the past year seventy sessions have been held with a total attendance of about 6,445. Upwards of sixty subjects were treated. A special effort has been made to have local institutes established in the farming districts throughout the State and to arrange for county conventions. This effort has been measurably successful. An active interest has been aroused among the people and systematic work accomplished.

The farmers institutes are yearly growing in interest and value. The attendance is improving and more active participation in the discussions by the farmers is had. A statement is appended to this report showing the places and dates of meetings held during the past year, the number in attendance at each meeting and the names of the speakers. Some of the principal papers presented and discussed at these institutes are printed in this Annual which is published by the College for free distribution in the State.

It is interesting to note the growth of the farmers' institute work in the United States. It has undoubtedly been a great factor in the development of agriculture, though it is a comparatively new thing so far as it relates to state aid and systematic management. During the past year the different states appropriated $219,157.62 for farmers' institute work, an average of about $5,000 by each state. A majority of the states, among them Utah, are required by law to print an annual report of the proceedings. Pennsylvania appropriated $20,500, New York $20,000, Minne-

sota $18,000, and other states ranging from near those amounts down to $250, which was the smallest amount appropriated by any state. The total attendance at the institutes was about one million.

The institute work in a majority of the states is under the management of the state agricultural colleges, and in all states the principal work is performed by agricultural college and experiment station workers. A recent development of farmers' institute work is the farmers' institute "special." In several states a special train fitted with apparatus and material for illustrating the talks given, goes from one town to another carrying lecturers, and making stops at the towns and villages on the way where the farmers have gathered pursuant to announcement previously given. Varieties of grains, grasses, fruits, etc., are shown, dairy equipment is explained and instruction in buttermaking given. In Missouri a special poultry car was sent over the State carrying poultry of different breeds and poultry appliances, accompanied by a lecturer. In several states "corn specials" with speakers were sent out with the special object of enlightening the people on corn culture and methods of seed selection. The farmers' institute special has been aptly called a "college on wheels."

In many of the states paid lecturers, usually men of practical experience, are kept in the field for several months of the year. Where this system prevails advantage is taken of securing new talent each year, and in this way new ideas are carried from one state to another. In Utah this has not yet been possible with the means at command. The State is large and population scattered, entailing much traveling and consequently much expense, which combined with the expense of printing reports precludes a more active farmers' institute campaign.

Agricultural College of Utah,
Logan, Utah.

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Summary of Farmers' Institutes, July 1, 1905, to June 30, 1906.

PLACE OF INSTITUTE		DATE	No. of Ses-sions	ATTENDANCE			SPEAKERS
TOWN	COUNTY	1905		Men	Women	Total	
Mt. Pleasant	Sanpete	Dec. 12	2	105	85	190	Jenson, Cotey, Frederick
Gunnison	Sanpete	" 12	1	46	14	60	Jardine, Wyant
Manti	Sanpete	" 13	3	550	100	650	Jenson, Frederick, Bolte, Cotey, Northrop, Wyant, Jardine, McLaughlin
Monroe	Sevier	" 14	1	75	15	90	Jenson, Cotey, Bolte
Monroe	Sevier	" 15	2	40	36	76	Northrop, MhLaughlin, Cotey, Wyant
Junction	Piute	" 15	1	26	4	30	Jardine, Frederick
Marysvale	Piute	" 15	1	17	8	25	Jardine, Frederick
Richfield	Sevier	" 15	2	190	60	250	Bolte, Northrop, Cotey, Wyant, McLaughlin, Jenson
Ephraim	Sanpete	" 16	2	200	30	230	Jardine, McLaughlin, Cotey, Wyant, Bolte, Jenson
Fairview	Sanpete	" 16	2	100		100	Frederick, Northrop
Beaver	Beaver	" 18	1	32	8	40	Jardine, McLaughlin
Beaver	Beaver	" 19	3	120		120	Jardine, McLaughlin, Frederick, Jenson
Fillmore	Millard	" 18	2	121	4	125	Northrop, Bolte
Lehi	Utah	" 19	2	245	100	345	McLaughlin, Cotey, Bolte, Wyant, Jardine, Northrop
Spanish Fork	Utah	" 20	1	110	40	150	Frederick, Cotey, Wyant, Northrop
Levan	Juab	" 20					Jardine, Bolte
		1906					
Elwood	Box Elder	Jan. 23		150		150	Clark, Jardine
Nephi	Juab	Feb. 23	2	221	50	271	Paxman, Kerr, Yoder, Northrop, Cotey
Nephi	Juab	" 24	3	246	78	324	Clark, C. H. Grace, Yoder, McLaughlin, I. H. Grace, Mantor, Cotey, Mrs. Cosair
Beaver	Beaver	" 26	2	200	60	260	Kerr, Northrop, McLaughlin
Moroni	Sanpete	" 26	2	167	5	172	Yoder, Jenson, Clark
Spring City	Sanpete	" 26	1	71		71	Yoder, Jenson
Fairview	Sanpete	" 27	1	43		43	Jenson, Yoder, Clark
Mt. Pleasant	Sanpete	" 27	1	121	22	143	Jenson, Yoder, Clark
Parowan	Iron	" 27	1	100	80	180	Northrop, McLaughlin, Kerr

Summary of Farmers' Institutes—Continued.

PLACE OF INSTITUTE		DATE	No. of Ses-sions	ATTENDANCE			SPEAKERS
TOWN	COUNTY	1906		Men	Women	Total	
Cedar City	Iron	Feb. 28	2	245	165	410	McLaughlin, Northrop, Kerr
Salina	Sevier	" 28	1	65	25	90	Jenson
Ephraim	Sanpete	" 28	1	56		56	Yoder, Clark
Monroe	Sevier	Mar. 1	1	77	16	93	Clark, Jenson, Yoder
Richfield	Sevier	" 1	1	82	10	92	Clark, Jenson, Yoder
Elsinore	Sevier	" 2	1	45		45	Clark, Jenson
Monroe	Sevier	" 2	2	102	48	150	Yoder
Smithfied	Cache	" 1	1	60		60	Stewart, J. Crockett, Jardine
Logan	Cache	" 10	1	25		25	Jardine, Ball
Kaysville	Davis	" 27	1	175	130	305	Bolte, Frederick
Huntsville	Weber	" 28	1	69		69	Yoder, Bolte, Frederick
Farmington	Davis	" 29	2	61	6	67	Thomas, Frederick, Bolte, Yoder
East Bountiful	Davis	" 29			7	7	Discussion, no addresses
Riverton	Salt Lake	" 31	1	17		17	Yoder, Bolte
West Jordan	Salt Lake	" 31	1	19	7	26	Bolte, Yoder
Morgan	Morgan	" 31	2	73		73	Hickenlooper, McLaughlin, Ball, J. E. Taylor
Benson	Cache	" 31	1	15		15	Clark, Thomas
St. George	Washington	" 2	1	45	4	49	Kerr, Judd, Northrop, McLaughlin
St. George	Washington	" 2	1	45	30	75	Kerr, Northrop, McLaughlin
St. George	Washington	" 3	1	40	2	42	Judd, Northrop, McLaughlin
St. George	Washington	" 3	1	200	100	300	Kerr
North Ogden	Weber	" 25	1	42		42	Northrop, Ball
Five Points	Weber	" 25	1	52		52	Northrop, Ball
Hooper	Weber	" 26	1	47		47	Northrop, Ball
Wilsons	Weber	" 26	1	66	2	68	Northrop, Ball
Plain City	Weber	" 27	1	42		42	Northrop, Ball, R. E. Wilson
West Weber	Weber	" 27	1	32	1	33	Ball, Northrop, R. E. Wilson

Attractions in Farming for the Boys and Girls.

I. ATTRACTIVE HOMES.

BY P. A. YODER, UTAH EXPERIMENT STATION.

The more experiences I have of life in our cities, the more I realize the meaning in Whittier's poem, "The Barefoot Boy."

Blessings on thee, little man,
Barefoot boy, with cheek of tan!
With thy turned up pantaloons,
And thy merry whistled tunes;
With thy red lip, redder still
Kissed by strawberries on the hill;
With the sunshine on thy face
Through thy torn brim's jaunty grace:
From my heart I give thee joy,—
I was once a barefoot boy!

* * *

All too soon those feet must hide
In the prison cells of pride,
Lose the freedom of the sod,
Like the colt's, for work be shod.

* * *

Ah! that thou could'st know thy joy
Ere it passes, barefoot boy!

There is a certain freedom in country life which it is hard to describe, and which can usually not be appreciated until one has for some years been deprived of that freedom by being shut up in the city and bound to the conventions and artificialities of city society. The sense of this freedom is too often lost in the feeling of monotony, with the result that there is a strong tendency

for the young people who are brought up on the farm, to give up that life for the more attractive professional or business life in the cities.

The mind of a normal, healthy boy or girl craves to be active and it is probably more so because of a lack of things, about which to think and upon which to exercise the mental faculties, than from any other cause that farm life becomes irksome to these people.

Probably the next most important cause of the boys leaving the farm is because they get the notion that farming does not pay. I hope to deal with these two features in the boys' farm life at another time, and now pass at once to another important cause of the boys' and girls' leaving the farm.

The farm must satisfy the boy's longing for attractive appearance, if he is to remain contented with farm life. If he finds about his home on the farm everything in a dilapidated, topsy-turvy condition, then sees neat and attractive homes in the city, he will naturally long for the city home. All too frequently, and usually unnecessarily, this comparison between a farm home and a city home holds true. The fact that stock are kept on the farm, makes it the more difficult to keep nêat surroundings. It, however, does not make it impossible. It only requires a little attention at the proper time; a litle work at odd hours of morning or evenings or vacant afternoon, probably instead of loafing at the corner grocery or at a worse place! an insignificant outlay of cash for lumber, posts, grass seed, etc., to convert the repulsive, dilapidated, tumbled-down home, overgrown with weeds and overrun with stock, into a neat, orderly, attractive home that will be the delight and pride of the boys and girls. There is no necessity for having the corrals extend all around the house and the manure piles spread all over the corrals, and even over the house yard. Any farmer can find half an hour now and then without in the least reducing thereby the earnings of his farm, to reset that leaning fence post ;to nail on that loose board; to fasten that gate to its hinges; to mow down those weeds; to level off the door yard and sow it in lawn grass; to straighten out and re-gravel that walk; to paint that lawn fence; or to repaint the house in some delicate color. But why do all this himself if he has boys whom he hopes to develop into progressive and contented farmers. It is the best opportunity that he could wish for to get the boys inter-

ested in the farm home. Let the boys think and plan what could be done to improve the attractiveness of the home. Let the boys make the repairs and improvements with only such help or suggestions as are necessary to make the work most effective. In conversation with friends and neighbors give the boys their full share of credit for the improvements. Nor are the girls excluded from these pleasures. It is most appropriate that they should also have a hand in the improvements of lawns and walks, and especially the setting out and care of flower beds and even the shrubbery or trees. The girls, however, have another equally extensive field for improvements, viz., the home indoors. What farmer does not spend in course of a year ten or twenty dollars or even fifty or a hundred dollars in a way far less effective than for a few new posts, some lumber, some grass seed, shrubbery and trees, or paint and brush.

While it is the premises, first of all, that should receive this treatment, it need not be limited to the premises. Extend it over the whole farm and the boy's pride in his and his father's business will be doubled. This movement for improvement need not even stop with the limits of the farm. Each can use his influence towards securing general neighborhood improvements. This applies especially to the public roads. Probably next to the home itself, no feature in the country surroundings has so great an influence on making country life attractive, or the reverse, as the conditions of the roads. If a well macadamized, mudless and dustless road leads to the neighbor's house, or the school or meeting house, or the nearby towns, then do you think the country boy or girl will envy his or her city cousin their paved streets and clean walks. For a pleasure drive of the young man with his sweetheart some pleasant Sunday afternoon, compare if you will, a ten-mile stretch of smooth macadamized country highway bordered with waving grain fields, sweet-scented meadows, fine herds, neatly kept country homes, and pure atmosphere, with the chopped up streets and blocks of the city, crowded with vehicles and pedestrians, hideous with the innumerable noises, and with the stifling atmosphere laden with the smoke of myriads of chimneys. Which will be the choice of our young people? Even the city cousins have learned to seek the country for pleasure drives. Nor is it an idle dream to think of having such country highways. The pioneers of this country have had more difficult tasks before

them. They cleared their fields and spent much labor in leveling them. They dug extensive and costly canal systems to bring to the land the life giving water. They even at times had to fight hostile natives to protect their homes. With it all, they succeeded in making a comfortable living and were apparently the happier for their efforts. Is there now nothing for the present generation to do but to sit in an easy chair and reap the benefits of these exertions of our forefathers? We can justly pronounce great honor upon the generations that have preceded us and accomplished these things, but what can we do for the future generations that can give them occasion to point to this generation with words of praise for our industry and sacrifice for future generations? What worthier ambition can be set before us than for the present generation to construct good macadamized highways to connect all our principal communities? We can do it, and that too, with no more sacrifice than previous generations have made for us.

A little thoughtfulness, a little industry, a little saving of useless expenditure here, and a little outlay for improvements there, may easily be combined to make the farm home the pride of our country boys and girls, and the envy of our city cousins who are so unfortunate as not to have been born on a farm.

Attractions in Farming for the Boys and Girls.

II. PROFIT IN THE BUSINESS.

By P. A. Yoder.

If the boy becomes convinced that life on the farm means a continuous struggle for a mere living with no hopes for the accumulation of sufficient property by the time he reaches middle age to be well-to-do or independent, and if he continually sees others in mercantile and professional pursuits accumulating comfortable fortunes, then it will require other exceedingly powerful attractions to make him choose the farm life. Nor can we blame him. It should be the aim of all of us to attain to comfortable financial circumstances in middle life and independence in old age. If, therefore, the boy is to be kept on the farm, he must become convinced that farming pays. But, as a matter of fact, does it pay? Do we not have the fact before us that thousands of the farmers about us have been in business for half a life-time and yet have not much more property than they had to start with? This may be so. It is an important consideration in this connection, however, that they are holding their own, and are making a living for themselves and family. If we carefully consider the way they conduct their farming business, we find hundreds of places in which they could improve and thereby increase their profits. If the haphazard methods of farming furnished the living, then all these added profits from improvements in the farmers' methods can go directly towards increasing their bank accounts. In other words, if present poor management of the farming business yields a living, it is clear that with the best methods known, handsome profits would come from this industry. It requires alertness and thoughtfulness to farm with good profits, as well as to carry on any other business or a professional career with profit. The farm manager must be informed of the best methods of handling the soil, his crops, his stock, etc., to get the biggest returns for his investment. He must keep abreast of the times to learn the new facts which the experience of others reveals and which may find application in his work. In this he

has a decided advantage over those in other pursuits in that there is a vast army of well trained men at work to gain such experience as shall benefit him, and the reports of the results of their experience can be had by the farmer for the asking. I refer to the work of the Agricultural Experiment Stations and the Department of Agriculture. No other industry in this country is thus favored. The farmer can have, gratis, bulletins, reports, yearbooks, etc., to guide him in his work such as an engineer, a lawyer or a physician would have to pay anywhere from twenty-five cents to twenty-five dollars for, if he wished to procure publications equally helpful in his profession. The main trouble at present that prevents farming from being profitable is not that the land is expensive, or the labor high priced, or the products low priced. The trouble lies in the habit of thoughtlessness that the majority of the farming class have fallen into. If the farmer would give half as much study to how to produce the most and the best crops most economically, and how to market them most profitably as the physician does to learn the best methods of treating his patient, then the chances are a hundred to one that the farmer would earn a comfortable living and rapidly accumulate a handsome bank account besides.

An accurate system of bookkeeping which will enable the farmer to see at the end of the year what occasioned the expenditures and what afforded the income would do much towards helping him on to the road of success and prosperity. The task of keeping the books might very appropriately be turned over to one of the boys for a few years prior to his leaving the old homestead to start in the business for himself. The majority of boys would delight in such a diversion, and through it would develop business-like habits of dealing with the farming industry. There really is about as much occasion for the farmer to keep books in his business as for the manager of a manufacturing or a mining industry to do the same thing.

It is true that the farm does not afford the opportunity to make enormous profits on small investments or in a short time, such as we frequently hear of in the mining industry or in mercantile speculations. Such reports, reaching the ears of the boys, often have a very pernicious influence. If at the same time they also heard of the scores of others who lose a small or large fortune in a vain search for gold or in unsuccessful speculative ven-

tures, then the influence might not be so pernicious. While the farm does not offer the opportunity of suddenly doubling one's wealth, it does offer the opportunity for steady advancement, and in the long run the chances are as favorable for advancement as in these other lines of business, and the hazards are not nearly so great.

If the boy is to be attracted to farming as a life industry, then his attention should during his boyhood days be directed to these phases of his business, and to such comparisons. He must be made to feel an interest in the old farm in a business way. He should be asked to help plan the operations having in mind the profits that are to accrue therefrom. It might be advantageous to have the boy personally share in the profits, though I admit there is danger in this. If the boy has control of much pocket money it requires extra vigilance and training to prevent him from developing spendthrift habits. If, however, he has the funds and is led to make thoughtful investment, it is a decided advantage. Along the same line, it is quite commendable for parents to let the boy earn a lamb, or a calf, or give him a garden plot, which is to be all his own and managed wholly by him, the profits also coming to him.

The central purpose in all this is to develop in the boy an interest in the farm as a business, and to train him in business habits in dealing with the farming industry. With these two points accomplished, we have done much towards keeping him on the farm.

Attractions in Farming for the Boys and Girls.

III. THE FARMER BOY'S EDUCATION.

BY P. A. YODER.

We may do what we can to make the farm an orderly and attractive place and to convince the boy that farming is a business that, for profit, compares favorably with other industries, yet if the boy feels that farm life is nothing but monotonous drudgery year in and year out, then he will hardly choose farming for his life work. When we study more closely the nature of the boys or the girls, we find that their minds as well as their bodies are naturally active and want something to do. If they have not plenty of things to think about they feel a chafing which they cannot explain, but which is just as real as the pangs of hunger when the body suffers for want of food, or the restlessness of limb when the boy is made to sit quietly in the corner and look prim while he is wanting to be out chasing his companions all over the premises.

When the boy goes to school he becomes interested in the new things that he learns about in his books. He relishes this mental food which he finds in his school work. In many cases this school work becomes an attraction to the boy that overshadows any attraction which the home or the farm affords him, even to the extent of drawing him away from the farm and leading him to choose a career which involves more of this going to school. This tendency of the school work has even led many a well meaning farmer to oppose all education above the most elementary, on the grounds that it draws the boys and girls away from the farm. It is a very common notion that the boy who does not get along well in his school work, i. e. the dull boy, must perforce remain on the farm, but the boy who enjoys his school work and does it well, has the way open for a more attractive professional or business career and that it would be a waste of ability for him to engage in farming. With the progress that has been made in scientific agriculture there is, however, no need now to think that in farming there is nothing on which a scholarly man may exercise his intellectual ability. As the farm life brings

the boy close to Nature in its various phases, there is also no ground for the notion that it does not afford him anything to think about. The trouble with our school work has been in some measure, that it filled the minds of the pupils with matter not closely related to the farm, and thus led him away from, rather than towards habits of thoughtfulness concerning matters pertaining to the farm. If, however, his school work includes effective nature study work, or if farther along in his high school course he studies some of the natural sciences, and especially if this nature study work or the elementary sciences which are taught, are shown to have bearings on his farm work, then instead of leading him away from the farm for mental activity, he finds the objects all about him full of interest. As one interested in the success of agriculture, I rejoice that the movement of modern education has been towards a closer study of Nature, and that at present there is a strong movement under way to make this study of Nature or the natural sciences in our rural school bear directly on agriculture. To a pupil thus trained in his school course the farm has quite a different aspect. The sprouting seed, the flowering plant, the creeping bug, the worn pebble, the grazing herds, will all have a special attraction for him because he sees in them some connection with interesting studies he had in school.

Imagine, if you will, a plowman who has not had his mind directed to a study of Nature about him. How will his mind be occupied as he wearily follows his plow? He finds nothing of special interest in that soil, those plants, or those worms, etc. As he walks along with his eyes idly fixed on the turning furrow his mind is probably occupied with interesting (?) thoughts something like this: "How nicely the sod turns over! How nicely the sod turns over!" and this line of thought continued from morning until noon, and again from noon until night. How do you imagine such an occupation would satisfy the restless mind of an active intelligent boy. Now imagine another plowman. In his younger days he studied botany, zoology, physics, chemistry, the soils, animal and plant breeding, feeding, etc. How will his mind be occupied as he follows the plow? Probably his mind runs like this: "What species of plant was that which I just turned under? Was it that pernicious weed? Was it one of those fertility gathering legumes? Was that worm a plant pest? Is it late planting that avoids its ravages? Does that soil appear to have enough

humus? Wherein is that fine team not of the perfect draft type? How is their endurance affected by this new ration that I have been trying? What plan of breeding would give best results with that dairy herd in the meadow yonder? What change can I make in my scheme of rotation to better conserve the fertility of the soil? What book shall I next buy for my boy? To what school shall I send him when he has finished the grades?" Such and other equally interesting thoughts would probably occupy the mind of the educated plowman as he follows his plow from morning till night. He finds the day too short to think over all that attracts his attention. His mind has been too busy to take notice of how weary his limbs are.

Which type of a farmer would you like to be, young man? If you have a chance to be one of the latter, then what attraction can the monotonous "grind" of a mercantile life have for you? If you are a bright and industrious boy you can take your choice. With our free public schools and colleges, and with the abundance of opportunities to earn enough for running expenses, you are not excluded because you happen not to be rich. A bright mind, an industrious nature, and a good supply of "stick-to-it-iveness" is your necessary capital. If you have this capital and are seeking a profitable investment, let it be in a preparation for scientific farming, and you will not need to fear a lack of reasonable returns either financially or in the pleasures of intellectual activity. If, however, you are a dull boy; if you do not like hard work, either at school or elsewhere; if clear-headed thoughtfulness gives you no pleasure, then you have insufficient capital to succeed as an up-to-date farmer. You would better prepare to be a lawyer or a politician or a grafter or seek a job in the corner grocery.

If you are ambitious to be a leader among your fellowmen, what leadership could you aspire to that would be nobler than to lead the tillers of the soil to better methods and more prosperous times? If you have the missionary spirit, and are ambitious to do something to uplift humanity, then strive to lift up agriculture and you will help all classes, for upon agriculture all are ultimately dependent.

Farming is a dull life for a dull boy, but for the boy who gets an appropriate education and engages in it studiously and thoughtfully it is an interesting and therefore attractive occupation.

Dry Land Farming.

By W. M. Jardine, Utah Agricultural College.

Notwithstanding the fact that farming without irrigation in Utah has reached great proportions within the last two years, there is still considerable room for improvement and much to learn in this new field of agriculture. Dry farming today, even by the most widely experienced farmers, can be considered as a reasonably certain business only when they adhere closely to the laws of nature as affecting plant growth, and aid nature whenever possible by means of the most improved methods of farming. The soil must be handled on an economic basis, in fact, the whole business of growing crops without irrigation must be done in an economic manner if made profitable, and in order to do this, up-to-date and especially adapted machinery must be used. Reliable literature on Arid Agriculture is available to every farmer desiring to inform himself upon the subject. This material can be obtained for the asking from the Experiment Station or at a nominal cost by subscribing for an agricultural paper which devotes some of its space every month to the discussion of dry land farming questions. There is, therefore, no reason for any person to enter this field without a thorough understanding of, at least, a few of the most essential and fundamental principles of crop production and a slight knowledge of what it takes to make plants grow.

Notwithstanding these facts, there are, in the heat and excitement of this new movement, thousands of acres of poorly adapted land for dry farming being bought of the State by incompetent men, men who have never had experience in farming of any kind, as well as by many farmers who are equally as helpless, because of the fact that they have been farming in a careless, hit-or-miss manner and hence are incompetent to enter a field of agriculture that requires in its management the best judgment that the country can produce.

Not all of these men, of course, who are entering this field for the first time are going to fail. Some of them will pay dearly for their experience, while others that have gone into the subject thoroughly before beginning operations will succeed, be-

cause they have prepared themselves for their work and have selected their land in the right place. Such men are going to be successful just the same and for the same reason that they would be successful in any other business. They are going at it in a business-like way. They understand their proposition.

Farming is an art, a business, and a science and as such must be thoroughly understood in order to make for success. In other words, the man of the arid farm today must be a scientific as well as a practical farmer. With our present limited knowledge of dry farming, the growing of crops in Utah or in any other section of the arid belt, where the annual rain fall is limited to 10 or 12 inches, cannot be considered as easy or even encouraging; and yet there are men that are remarkably successful, as a result of their own hard efforts. We have yet to learn in this new field of agriculture how we can best hold in the soil the moisture that falls as snow and rain until the plant can use it to the best advantage. We need to learn of and to develop more hardy and drouth resistant plants to grow. The farmer must become, to a certain extent, an experimenter. He must find out a few of these things for himself, since the conditions under which dry farming is practiced are so varied as to make it impossible for any set rule to govern a very extensive section. But where the rainfall is as much as from 12 to 20 inches, dry farming can be and is being made a very profitable, pleasant business, even by second-class farmers. Their success, however, is due to favorable location rather than skill in farming.

The things to be considered in locating a farm are: first, suitable location as to rain fall; second, character and depth of soil; third, location as to suitable market facilities. With these three points well in mind and closely observed at the time of locating a farm, there should be no occasion for failure so far as land, rain-fall and market facilities are concerned. The main requirements will then be brains, accompanied by some training and good judgment.

There are in Utah today, as well as in other western states, large tracts of fertile land, suitably located for dry farming open for settlement; hence there is no reasonable excuse, this early in the history of this new industry, for any man selecting a farm in a poor location.

A dry farm located in a section where the precipitation is

equal to or exceeding 12 inches, and where the soil is of a clay or loam nature to a depth of 18 inches, or preferably deeper, and underlaid with a clay subsoil, will be suitable to the growing of any of our ordinary crops, such as wheat, oats, barley, alfalfa, corn and potatoes, and the most drouth resistant varieties of grasses. Especially will this be true if the land is summer fallowed for the purpose of storing up two years' moisture to produce one crop, a common practice with the best farmers today. But where the rain fall is less than 12 inches, only the most drouth resistant crops can be grown with any degree of certainty. It is for such localities that new varieties of a harder nature must be developed.

The future development of dry land agriculture will depend largely upon the ability of the scientific investigator and upon the ability of the practical farmer to develop hardy varieties and to keep up these varieties by careful and continued processes of seed selection. By such a system, better plants and a better agriculture can be developed for the desert lands of these intermountain states. Yields can always be increased, quality of crops improved and hence, better prices obtained and more money brought in, if strict adherence to plant and seed selection is observed. Grain that is to be used as seed should be selected just before cutting, while yet in the head. The following plan offers a very simple method for selecting seed from year to year: Begin by selecting enough seed of the very best seed possible of the very best variety known for one acre of land; from this acre of grain select, while the crop is yet standing, just before harvesting, enough seed for another acre from the very best plants. Harvest the remainder of the crop from the acre plat for seed to be used on the commercial field. Repeat this process the second year, reseeding a third acre for the third year, always seeding the commercial field from the selected plats, as far as the seed will go. Never change seed with your neighbor, unless for some reason or other you have mixed your seed or for other reasons which makes it absolutely necessary. If this method of selection is continued for a number of years, there will have developed a pedigreed wheat. A pedigreed strain of grain means just as much to a farmer as a pedigreed strain of animals means to the stock grower. Farmers are willing to pay for a pedigreed variety and any farmer who will go to the extra trouble that is required in

seed selection will be doubly paid for his trouble. He will be of inestimable value to his community, and at the same time he will be doing a great work for the cause and advancement of agriculture.

Pure seed is not all that is required, however, to make dry farming pay. The land should be well prepared to receive the grain, plowing whenever possible in the fall of the year. The plowing should be deep; and, in the early spring before a crust has had time to form, the soil should be thoroughly disked to a depth of 2 to 3 inches, so as to form a mulch that will check the evaporation of water from the soil. Where the land is to be summer fallowed, this cultivation should be continued after every rain during the summer, until seeding time.

After crops such as wheat, oats, barley, corn, potatoes and alfalfa have started to grow in the spring, the land should be gone over with a spike toothed harrow, and sometimes with the disk harrow, in order to loosen up the top layers of the soil and thus form a mulch that will check evaporation, warm the soil, and stimulate the growth of the plant. Every alfalfa field, whether under irrigation or not, should be thoroughly disked to a depth of 3 to 4 inches every spring.

Special machinery should be used in farming dry lands. Machinery sufficiently large to permit of one man handling many acres, thus eliminating so much expensive labor. Plowing and harvesting by steam power is fast coming into use where farming is conducted on a large scale. In order to dry farm successfully it is quite necessary to cut down all expenses to the minimum. This is necessary since the money value per acre is so small, especially when the average yield of wheat is not more than 10 to 15 bushels per acre. All farm operations must be conducted on a large scale in every respect. Ten bushels of wheat per acre means five to seven dollars in money, and unless great economy is practiced in producing the crop, there will be no net profit. With modern machinery and up-to-date methods of farming it should not cost, on an average, more than $3.00 per acre for the production of a crop. Five hundred acres of wheat at a net profit of $2.50 to $5.00 per acre is not to be laughed at and is entirely possible if wise methods of farming are pursued.

Brome Grass for the Arid Region.

BY W. M. JARDINE.

One of the best varieties of cultivated grasses ever introduced into an arid region, owing to its ability to withstand drouth, is the variety known as Brome Grass (Bromus inermis).

This grass is a vigorous, hardy perennial, with strong creeping root stalk, and smooth, upright, leafy stems growing from two to five feet high. This grass was introduced from Europe into this country about twenty years ago. But it is only of recent years however, that its true worth as a drouth-resistant plant has become known. It is valuable for both pasture and hay. All stock relish it, and at the North Dakota Experiment Station it gave better results in feeding experiments with horses than did good timothy hay. As a pasture grass for dairy cows it gave excellent results at the Nebraska Experiment Station.

That Station says of it: "All things considered Bromus inermis is the most promising cultivated pasture grass for this State that has been tested on the Station Farm." We have found this to equally true for Utah, especially where it is grown without irrigation. Extended cultural tests through the country show that Brome Grass has remarkable drouth-resistant qualities, and is the most suitable grass yet introduced for the dry regions of the arid west.

For the past four years Brome Grass has been grown under experiment at the Utah Station. It has been grown both with and without irrigation, and in most instances the results have been satisfactory.

While Brome Grass responds readily to the use of water, it succeeds equally well without irrigation where the annual precipitation is not less than twelve inches. The very best yield obtained, in the four years that we have been experimenting with this grass in Utah, was from a plat that has never been irrigated, the yield going a little better than three tons of air-dried hay per acre. The stand will make at least two tons per acre. It makes first class pasture grass as it thrives well on all kinds of soil and tests through the State indicate that it is

adapted to a greater range of territory than any other grass in this section of the country. Its advantages over the native grasses are that it becomes green at least two weeks earlier in the spring, and that it remains green longer in the fall of the year.

Brome Grass is a deep-rooted crop and for this reason is well adapted to a dry climate. Its roots often feed into the soil to a depth of from six to eight feet, while the roots of timothy seldom extend farther than three and one-half feet.

Brome Grass is best seeded broadcast at the rate of from fifteen to twenty-five pounds to the acre. Great care should be taken in securing the proper variety, since there are several different varieties of Brome Grass, none of which are as good as Bromus inermis.

A thoroughly prepared seed bed is very essential if a good stand of grass is expected. The seed is very small and light, and for this reason is difficult to germinate. If a good stand is secured in the start it will need very little care thereafter.

The land should be plowed in the fall of the year to a depth of from eight to twelve inches, then thoroughly worked over the following spring as early as possible and just before seeding. The seed should not be covered more than one-half inch deep. If set deeper than this the tiny shoots will break their necks in trying to get through the soil. Very good results have been obtained from seed sown over the surface of the soil, and left without further treatment.

After a stand has once been secured it should be thoroughly disked in the spring of each year, and whenever possible, manure should be applied to the soil during the fall or early spring. The increase in yield that will be harvested from the land by this method of treatment will more than pay for this extra expense in caring for the land.

Brome Grass is a close rival to alfalfa on the dry lands of the far west, and, in the writer's opinion, is even better as a drouth-resistant crop. Brome Grass has certainly come to stay and it is only a question of time until hundreds of tons of this hay will be produced under dry land cultural methods of farming. It will facilitate an excellent rotation of crops with the cereals and alfalfa, and at the same time furnish a succulent forage to be used along with straw as feed for cattle and sheep, in this way again increasing the revenues of the dry lands.

Alfalfa Seed as a Profitable Arid Farm Crop.

By John Stephens.

It has been clearly demonstrated in many localities of the arid west that wheat can be profitably grown without irrigation. While several other cereals have been grown with more or less success on the experimental farms in Utah, the farmers generally seem to be giving all their attention to wheat production. This, perhaps, may be wise, but with proper cultivation and treatment alfalfa can not only be grown as a forage crop on desert land, but the production of alfalfa seed can be made a source of more profit, possibly, than any other crop. When we take into consideration that alfalfa seed sells for from ten to twelve cents a pound, it can easily be seen that the production of a few bushels of seed per acre would make the cultivation of arid land a paying proposition. To produce a crop of alfalfa seed requires less moisture than is necessary for the production of a crop of hay. This is evident from the fact that it is almost impossible to grow seed under irrigation. Where the moisture is plentiful, the growth is usually too luxuriant for the production of seed. If the growing of alfalfa seed, then, is not dependent to any great extent upon soil moisture, why is it not grown more extensively on Utah arid farms. In Cache County several farmers have this year raised from four to six bushels per acre. Although this is the first year alfalfa seed has been grown on the State experimental farms, the results, generally, have been very satisfactory.

Like other arid farm crops the matter of preparing the soil for seeding is an important point to consider. The soil, as for wheat, should be fall plowed. More intensive cultivation, however, is required for alfalfa. The ground should be thoroughly disked and harrowed and then leveled, just before seeding.

Sow the seed with a press drill, using not more than five pounds per acre. Alfalfa that is seeded thick will not produce as much seed per acre as will a comparatively thin stand, hence seeding at the rate of 4 to 6 pounds per acre will give better results than will heavier seeding. A good stand of alfalfa can be

obtained any time from early spring to May 15, the time depending upon the location.

Run the mower over the young alfalfa the first year, but do not clip it back too closely. This will tend to develop root system and thicken the stand, and there will also be less danger of the plants winter killing.

In each succeeding spring after obtaining a stand of alfalfa, the land should be disked lightly and then run over with the smoothing harrow. This treatment, too, will apply with equal force upon fields of alfalfa whether grown for hay or seed, with or without irrigation.

Great care in harvesting the seed should be exercised as it is very easy to lose the profitable part of the crop through careless methods of harvesting. The mowing machine should never be used in cutting seed except when the stand is too short to be gathered with the self rake. The self rake is the only proper machine with which to cut seed. It is thus left in bunches over the field in a shape that it can easily be collected, after having been properly dried, with very little loss of seed from shattering.

Proper Care of the Ditches.

By I. H. Grace, Nephi, Utah.

The subject that I wish to present to this institute relates to the proper care of our ditches, and the water that we use for irrigation. It seems to me that when water is worth $75.00 per share (which is supposed to water one acre of land only) that it is worth while to see that none of it goes to waste.

Our farm (Grace Bros.) is located just one mile from the main canal that supplies water for the general field, and during the two years that the citizens of Nephi were allowed to grow sugar beets, we put in four acres during the months of August and September. If we could have secured two-thirds of the water, that left the main canal, upon our land without loss, we could have irrigated at least ten acres thoroughly; but on account of weeds and rubbish of different kinds, that were in the ditch, we couldn't get more than enough water to properly irrigate two acres of land. Now if we, together with those who are interested on the same ditch,would decide to put say forty rods of our ditch in condition so that it would insure at least two-thirds of the water that enters our ditch reaching our land, it would be a profitable investment. I believe that, in the case of raising beets, we could have produced more than enough of marketable beets, by having our ditches in good shape to have paid our proportion of the amount that it would take to put the forty rods of ditch in proper condition. If this was kept up for four or five seasons, our ditches would be made so that thereafter they would need but little attention each year to keep them in proper repair. How to construct such a ditch is the next question. I think for $2.00 or $2.50 per rod such a ditch could be made to take all the water that would come into most of our small laterals. My ideal would be to have a competent engineer give the proper grade, which would be the only cash out-lay. Then make a ditch semi-circular in form and large enough to admit a cobble rock lining on sides and

bottom, pounded solid, and otherwise put in in such a shape so as not to wash out. I think this in the end would be much more economical than the old plan, besides we would then get a full quota of water.

It costs the people on our ditch from $30.00 to $40.00 each year to keep the ditches in their present condition, which in my estimation should be doubled, or in other words, the ditches should be cleaned twice in a season, instead of once, which would make the cost nearly double. Then why not make our ditches right, and in a short time stop this never-ending outlay in cleaning each year. At the same time take care of the water, which in this state is almost as valuable as gold, and I might say the more valuable of the two. This may not apply to every ditch in our fields, but very many of them can be improved in this way, and the water made double its present value.

I hope that in the near future some plan will be inaugurated among us as a community to better our present conditions in this respect.

How Plants Feed.

By Robert S. Northrop, Utah Agricultural College.

Did you ever place a few seeds between two damp blotters on a plate and let them germinate? If you will do so, you may notice that as the roots develop there appear, just behind the tips, innumerable delicate, silky, hair-like bodies that glisten and resemble cotton fibers. These are the root hairs, the means by which plants absorb the water of the soil, which carries in solution the dissolved food, thereby supplying to the plant the materials required for growth.

Go out doors and pull a weed from the ground, choosing one that is growing in comparatively loose soil. Look at the roots of this and, though you do not see the root hairs as plainly as you can when the seeds are germinated between blotters, you will see that a great many soil particles adhere to the finer roots. These particles are held by the root hairs, which exist in great numbers, even if invisible. No doubt, if the plant pulled be lifted tenderly from loose soil, thus avoiding damage to these delicate organs, the greater amount of soil will be found just behind the tips of the smallest roots.

If anyone will perform, carefully, these little experiments, he can easily understand how plants feed and he will appreciate the necessity of the careful cultivation of his land. If the finest roots must press out and give off from the region just behind their tips these delicate hairs, which can scarcely be seen without a microscope, and which will not withstand the slightest handling, how necessary it is that the soil be deeply plowed and finely worked, in order that these hairs may develop to the fullest and thus take from the soil more of the elements necessary for growth and fruitfulness.

We know that the soil moisture exists as a film of water surrounding each soil particle from which the food used by the plants is dissolved. It is evident to all that if the particles are more finely broken and are loosened and freed from each other, it will be more easy for the root hairs to get in between them and absorb the food. Moreover, a greater amount of surface will be exposed to

the action of the moisture in the soil and more moisture can soak in during rains, for the pores are open and the water that comes will go down into the soil before it can run off. All of these advantages will increase the amount of food available for the plants.

Now, in order that the absorption of food and water by the fine roots can go on, it is necessary that air exist in the soil. If the soil is baked hard, air will not be present in sufficient quantity for more than a very few inches, but when land is deeply plowed, the particles of soil are so loosened that the fine feeding roots can secure a sufficient quantity of air at a much greater depth. This, then, allows them to feed throughout the entire depth plowed, and not merely in the upper two or three inches of soil, in consequence of which much more food is secured.

It is a law of nature that before a plant can produce seed or fruit it must have more food available than is required to satisfy the needs of growth and that the use of this food for growth be prevented by some condition of the plant's environment. Anything, then, which will check the growth of a plant will throw it into fruitfulness if a sufficient quantity of food is present and in such condition that the plant can get it. I have shown how, by deep plowing and cultivation, the feeding area is greatly increased, thus making it more easy for the roots to secure food. But those statements are not all of the reasons why thorough tillage will supply a surplus of food, thus making it essential to good orchard practice. After plants are growing, plowing and cultivating will cut off many small roots. This will cause them to throw out a much greater number of branch roots, which, we can see, will increase their absorbing area, because the root hairs are borne behind the growing tips. The soil, also, will be bettered in many ways by the organic matter turned under and by the chemical activities which are set in motion.

The checking of the growth of the plants is easily arranged for since we know that it is by the soil water that the food is taken in. If we cease cultivating in the middle of summer, it will be much more difficult for the plant to continue to supply water, because weeds spring up and much is lost by evaporation. The rapid growth of early summer cannot then take place and the food which has been taken in can go to develop the fruit on the tree or to prepare new fruit buds for the next year.

Starting an Apple Orchard.

By Robert S. Northrop.

During the past few years, apple growing has received a great deal of attention in Utah. Thousands of young trees have been planted and are developing into orchards which are beginning to give returns. Yet many of these are sure to be disappointing because they have been planted without a thorough understanding of the proper method of handling them. Diseased stock has also been planted and these trees are now beginning to turn yellow and die. Since there will, without doubt, be many thousands of trees planted within the next year or two, a few words upon the selection of nursery stock and the proper handling of trees at the time of planting will be appropriate.

VARIETIES.

If a small orchard is to be planted for family use those varieties ripening in succession from summer to late winter should be selected. One should also select those having high quality, thus making them more desirable for desert use, or to eat from the hand on the long winter evenings. The following varieties ripen in about the order named and a selection from them will be found desirable for this purpose: Yellow Transparent, Fameuse, Astrachan, Early Harvest, Chenango, Porter, Longfield, Maiden Blush, McIntosh, Grimes Golden, Bell Flower, Jonathan, Winesap, White Winter Pearmain, and Gano.

For a commercial orchard, we must consider the desires of the market. If the apples are to be shipped, as undoubtedly they would be, it has been found that a red apple of high color will sell to the best advantage. Those varieties having a tough skin, thus making them less liable to blemish will also prove more desirable than those which will not stand the rough handling of long shipments. Such varieties as Jonathan, Winesap, Gano, Missouri Pippin, and Ben Davis will be most satisfactory. There are some yellow varieties which in certain markets sell very well, but on account of

their color, bruises show very plainly and, unless handled with great care, cannot be avoided. Of this class the Grimes Golden, White Winter Pearmain and Winter Banana are most popular, and in local markets are good sellers.

NURSERY STOCK.

Some growers prefer to get stock as well developed as possible, thinking thus to get bearing trees earlier. No doubt two year stock will bear earlier than yearling, if both are neglected, but if the methods of forming the tree outlined in the latter part of this article are to be followed, it will be better to get yearling stock and then make them grow fast to make up the difference. This can only be done by giving them the best of care and cultivation, but the results will justify it. An orchard is not planned like an annual crop nor like an alfalfa field, but its life is long and each year, after the first few, should produce a profit. This cannot be done unless the orchard is kept in condition and the first essential is to have sound trees properly formed. We seldom in the past have found an orchard which, after five or six years, did not have several trees missing as well as several trees that looked sickly. A large part of such cases are due to the fact that diseased stock has been planted, but most of this could have been prevented if the planter had known the indications of the trouble on the young stock.

In the first place do not buy of the traveling tree agent unless he is personally known to be honest. Buy of the reputable nursery men, which ones matters not, for all of them without doubt have diseases in their grounds; but if they are honest the poor stock will be thrown away. When the shipment arrives, if possible have your county tree inspector on hand and no poor stock should pass his scrutiny, but in case he cannot be present, look out for any lumps, swellings, hairy roots all bunched together, or long, slender slick looking roots. These are indications of disease which may seriously interfere with the later life of the tree. If found they may be held until the tree inspector can come to see them and if he condemns them they need not be paid for.

PREPARATION OF THE GROUND.

The first requisite for success with fruit is a fertile, well

drained soil. If possible this should be selected with a slope towards the north or east, though other slopes often give excellent results. One that is low and frosty should be avoided equally with an undrained, soggy soil. It would be most desirable to plant on ground that has been in cultivated crops for several years; but in all cases see that the soil is deeply plowed and thoroughly worked before setting, and after planting continue to cultivate thoroughly throughout the life of the orchard.

PLANTING.

The distance at which to plant is a question that must be settled by the individual. Most men prefer to give each tree an average of about 400 square feet of ground; this may be in squares 20x20 feet, or in triangles, with every tree 20 feet distant from its neighbors, or in rectangles 16x20, 16x24, etc. It is well never to place them nearer than 16 feet and if at 16 feet, plant them with every other row of some quick producing sort which, after a few years, may be cut out to make room for the other trees. The Missouri Pippin and Ben Davis are good trees to plant as fillers to be removed.

Have the holes in which the trees are to be planted large enough so that the roots will not be cramped, and set the trees about three inches deeper than they stood in the nursery. Pack the soil firmly about the roots, being sure that no air spaces exist. If possible, irrigate them within a day or two. Trees handled in this manner will live if the stock is in a vigorous condition.

PRUNING.

Before planting, the roots should be cut back to good clean wood. Any that have been lacerated or torn in digging should receive particular attention in this respect. It is well to add that while doing this, careful inspection can be given each individual for all pests and diseases.

After the trees are set they should be cut back on top to compensate for the roots which have gone. If yearlings, they are merely whips and should be cut about 30 inches from the ground, not that the head is to form that high, but to force strong branches out along the stem. When these branches are formed

the best four or five will be allowed to remain, having them equally distributed around the tree and from four to six inches apart up and down the trunk. This will make a low headed tree from 12 to 18 inches) and one strongly built so that the trunk will not split down.

If two year stock is used the heads will already be formed. These are generally about right in number of limbs, though seldom have they been given proper attention as regards distribution of branches. These generally come off nearly together and on two sides of the tree, due to the closeness of standing in the nursery row. In all cases cut the limbs back quite severely, and if they are not well distributed up and down along the trunk, cut them even more severely, thus attempting to make them throw branches out below, for if they come out all together, they are much more likely to split when loaded with fruit, often all the way to the ground, thus ruining the tree.

Each year after planting until maturity the tops of all trees should be cut back heavily and thinned out to let in light. This will cause them to grow more strong and stocky, thus assisting the tree to carry a heavy load of fruit. Trees so handled will be profitable if the location is suitable.

Fig. I.

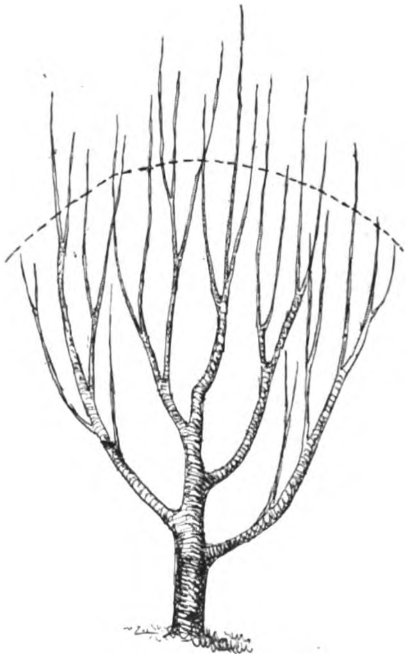

Fig. II.

FIG I. A young tree troubled with crown gall. Notice the long, slender roots and unnatural lump.

FIG. II. The way a three-year-old apple tree should appear. Notice the low head with main branches well distributed around the tree and up and down the trunk. The dotted line shows where to cut the young growth.

Diseases of Animals---Lumpy Jaw. (Actinomycosis)

By H. J. Frederick, Utah Agricultural College.

Characterization.—Lumpy jaw is a chronic infectious disease which occurs in cattle, swine, horses, sheep and men and is characterized by local inflammation and the formation of tumors which contain the causative factor of the disease. The tumors have either a tendency to develop into large and hard masses or to suppurate.

History.—The early history of the disease is quite obscure; before the discovery of the specific cause it was much confused with other diseases resembling it more or less. It was described by a number of names, the most common of which are swelled head, big head, and lumpy-jaw. By the latter name it is commonly known in America, while in Europe it is popularly known as "wooden tongue." It was first recognized as a specific disease in 1868 and was more or less investigated until 1877. Since that time it has been carefully studied and described by a number of investigators.

Distribution.—Actinomycosis is quite widely distributed throughout North and South America and Europe. It is more prevalent in some countries and districts than in others, yet its greatest prevalence is no doubt in connection with low, damp, rich bottom land.

This disease is found to quite a large extent in this state.

Causes.—Lumpy jaw is produced by a fungus growth commonly called the "ray fungus." The growing and multiplying of this fungus in the tissues is the direct cause of the disease. This fungus appears in minute yellowish granules which, when examined under the microscope, are found to be made up of rosettes varying in size. It has been supposed to grow on cereals and particularly barley, the beards of which favor its entrance into the wounds of the skin or of the digestive tract. In old animals the cavities in diseased teeth form a favorite starting place for the parasitic growth. It is supposed that in many districts cases have increased materially with the general use of barbed wire fences and the resulting skin wounds.

While lumpy jaw is an infectious disease it does not seem to be transmitted directly from one animal to another. Many investigators have tried to produce the disease by inoculating animals with pus from diseased animals, but in most cases they were unsuccessful while inoculating animals with diseased tissue containing the fungus has developed the disease. Another favorite point for this fungus to enter is the tongue, producing wooden tongue. It may also locate itself in the lungs.

Symptoms.—This disease is manifested by a firm swelling or tumor usually situated in the region of the head or throat. The swelling of the affected part somewhat resembles a bruise; some claim that many cases of actinomyçosis are caused by blows or injuries received by animals while struggling in stanchions.

The enlargement gradually increases in size and can easily be detected from the rest of the tissues.

On feeling of the tumor it seems hard, and if it is not the result of bulging of the adjacent bone it is usually attached to it. This tumor finally ruptures and a yellowish discharge issues forth, this may continue to flow or it may heal over to break later. When the tongue is affected the animal finds it difficult to eat.

The tumor is most frequently seen on the external surface of the jaw and usually begins in the connective tissue beneath the skin but soon extends to the bone.

This disease is not rapidly fatal, animals rarely if ever die from its immediate effects. The length of time they live affected with this disease depends on the location of the tumor and the rapidity of its development.

Diagnosis.—This must depend on the recognition of the fungus in the diseased parts. With open sores this is not difficult, but when unbroken they must be opened. The following points are grounds for suspicion: the slow progress of the disease, the almost total absence of pain or tenderness, spreading to all surrounding tissue, affecting nearby glands, and a tendency to form ulcerous sores on the surface leading to tumors of diseased tissue. Not all cases of swollen jaw are lumpy jaw, many are only abscesses, the result of some injury, and such are not invaded with ray fungus. The discharge is of a different nature, and the yellow granules are absent. This disease must be distinguished from tubercle and glanders, which is best done by the test for these

diseases; where no reaction occurs, they have some other disease.

In making a positive diagnosis of lumpy jaw it is necessary to make a microscopic examination of some of the diseased tissue and of the discharging pus in which the ray fungus may be found. Besides finding the lesions on the jaw, we have them on the palate, the lining of the nostrils, the pharynx, the fourth stomach, liver, spleen, kidneys, and peritoneum, the lungs, plurae, and the mammae.

In most of the cases we have examined, lesions were found only on the jaw. The disease is usually slow in its progress, though at times when the germs are distributed by the blood it may become acute.

Treatment.—In localized lumpy jaw removal by the knife (freely cutting the tumor) followed by disinfection with carbolic acid, creatin or copper sulphate, in about five per cent solution, is very successful.

Cases that have not been definitely known to be lumpy jaw have been treated by injecting potassium iodide solution (1 to 100) with good results.

Where a discharge has already taken place from the tumor it should be as far as possible removed and the cavity packed with absorbent cotton saturated with Lugol's solution.

Cavities in the diseased bones should be scraped out and disinfected in the same way.

In connection with removing the tumors, and as far as possible establishing free drainage of the part and disinfection, 1½ to 2½ drams of iodine of potassium, dissolved in water and administered in a drink once a day, should be used, the dose varying somewhat with the size of the animal and the effects produced. This should be kept up until iodine is produced in the animal (about one week). This manifests itself by the skin becoming scurfy and the eyes moistened or running and loss of appetite.

When these symptoms appear the medicine may be suspended for a few days and again resumed in the same dose. A cure requires from three to six weeks of this treatment.

Iodine of potassium should not be administered to milk cows, as it usually reduces the milk flow, furthermore a great part of the drug is excreted through the milk, making it unfit for use. It should not be given to animals advanced in pregnancy, as it may cause abortion.

It is the opinion of most pathologists that when the disease is restricted to small tumors and these are localized, the affected parts should be destroyed but the remainder of the carcass may be used for human consumption.

The federal meat inspection laws of the United States say: "If the carcass is in prime condition and there is no evidence on post mortem examination that the disease has extended from the primary area of infection (usually the head) it may be passed, provided the head, including the tongue, is condemned."

To prevent undue increase of the germ, animals affected with lumpy jaw should be promptly treated and, in case of failure, slaughtered. If they show general infection they should be safely disposed of. Stalls of such animals should be disinfected, after all the litter has been removed and burned, by a saturated solution of Cupric Sulphate or a ten per cent solution of carbolic acid or creolin. In districts where this disease is common, cleanliness and disinfection of wounds and sores should be carefully attended to. By the thorough cooking of such meat the danger of affecting human beings is overcome.

Diseases of Animals—Distemper. (Strangles.)

By H. J. Frederick.

Characterization.—Distemper is an infectious disease of all animals of the horse kind.

It is usually made manifest by a catarrhal inflammation of the nasal chambers and throat, producing swelling of the adjacent lymph glands or of the skin.

History.—Distemper is one of the oldest diseases we have among horses. It was described as early as 1664, and was known to be infectious, because it was later experimentally inoculated on animals that did not contract the disease by exposure.

Distribution.—Distemper is a widespread disease among horses. It stands among horse diseases much as measles does among diseases of the human family. It is a disease of colthood and more prevalent in a locality where many animals are raised than elsewhere.

Causes.—This disease is supposed to be caused by a germ, known as the Streptococus equi. This germ has been secured in pure cultures and inoculated into healthy horses, reproducing the disease. Youth strongly predisposes, most cases occurring between two and five years. The eruption of teeth, which is active in early years, causes congestion about the head and general body disturbances, making the system more receptive.

The changes produced in training or breaking and likewise in feeding may contribute to make the body less resistant.

Chill is a common cause. Change of altitude acts much the same, all tending to weaken the system and make it more susceptible to most germ diseases.

Symptoms.—The first indication of this disease is a rise of temperature. There is loss of appetite, depression and, at times, great weakness. This may continue for a few days when local manifestations are apparent which consist of a catarrh of the nostrils or swelling of the glands under the throat (Submaxillary and Pharyngeal). At first the discharge from the nostrils is serous and somewhat viscid, but in a few days it becomes purulent, and may be of a yellowish green color. This may take place from

one or both nostrils and may exist even as far as the bronchi. The swelling of the glands of the throat is usually hot and painful when pressed upon.

At times, distemper is accompanied by cutaneous swelling, which takes the form of an eruption of vesicules, and even pustules appearing, chiefly on the sides of the neck, shoulders, or chest. These swellings may appear suddenly and disappear equally rapidly. We have the disease assuming numerous forms. At times, we may even have brain symptoms where the swellings are indolent and slow to soften; then there is great dullness, prostration, drowsiness and general paralysis. If the lesion is in the spinal cord, the paralysis is likely to be confined to the hind parts.

Diagnosis.—In mild and regular cases this is easy. The rise of temperature, discharge from the nostrils and formation between the branches of the lower jaw, of a diffuse, hot, painful swelling, rapidly advancing to suppuration and discharge make the case quite conclusive. This disease must be differentiated from Purulent Nasal Catarrh, but in this there are no suppurating glands. It must also be differentiated from Glanders. In Glanders the lesions do not heal as rapidly as in distemper. Glanded animal react to the Mallein test, but not so of distemper.

Prevention.—In the older countries, horsemen too often accept distemper as inevitable. They expect that all horses will have it sooner or later, and it is not worth while to guard against it, however, there are places and breeding establishments in America where this disease never exists, though prevailing all around them.

During the existence of distemper in a district, exclude strange horses or mules from your stable. Keep young horses from public stables or yards, or from public drinking troughs or any places that might have been soiled by infected animals. Give good nutritious food; allow pure water; and disinfect all utensils, used for horses, when brought from another place or bought second hand.

Immunization.—An attack renders the animal immune, but this may be early overcome by changes of location and stronger infection than the first time.

Treatment. In mild, regular cases, hygienic measures only are demanded. Cleanliness, dry stalls, pure air, nourishing and easily digested food, pure water, in cold weather, blanketing may

suffice. Rest is indispensable, though exercise may be allowed in shelter.

For costiveness or tardy action of the bowels, two, three or four ounces of sulphate of soda may be allowed daily in drinking water or on grain.

If breathing is labored, it is well to steam the animal with the vapor of hot water to which has been added an antiseptic, such as a tablespoonful of tar, carbolic acid or creolin. This may be placed in a bucket and the bucket placed in a seamless sack and drawn over the nose of the animal. It may be continued an hour or more. In case of tardy softening of swelling, it may be covered with a linseed meal poultice to which a little carbolic acid has been added or a blister applied.

As soon as softening is detected, a free incision should be made to allow the exit of pus. Syringe every day with antiseptic and keep clean. Fever usually subsides on the opening of the abscess. When the discharge from nose or abscess persists, give injections of weak solutions of creolin or lysol. During convalescence, it is important to avoid over exertion and chill; keep the bowels open and cause the kidneys to perform their function by administering some laxative; and give about one spoonful of saltpeter in drinking water or on grain daily.

Economy of Farm Machinery.

By Jos. Jenson, Utah Agricultural College.

A machine has been aptly defined as "an assemblage of moving parts interposed between the source of power and the work, for the purpose of adapting one to the other." The "source of power" on the farm is usually either a team of horses or a steam engine which derive their power from the consumption of food or fuel. One of the most fundamental laws of nature is that whenever a change of any kind occurs which involves either a transformation or a transmission of energy (such as the transformation of horse feed or of coal into work or into transmitting energy in the form of an electric current, or by means of a belt, from one point to another) *some* energy is wasted. Under favorable conditions a steam engine will return one horse power of work for each 3½ pounds of coal burned per hour. But the energy represented by the burning of one pound of coal is about 10,000,000 foot-pounds and 3½ pounds per hour would represent a liberation of 35,000,000 mechanical units of energy per hour, or nearly 600,000 per minute. One horse power represents only 33,000 units per minute, thus we have a waste of 567,000 units, or approximately 94 per cent of the energy of the coal is wasted in being converted into work at the engine shaft. So with the horse, only a small portion of the energy represented by the food which he eats is represented by the work which he does. Here, then, is the first lesson. A good horse, like a good engine, is one that gives the largest returns for its consumption, not, as is often assumed, the ones which cost the least money in the first place. First cost should be counted as a secondary matter, and efficiency always first. Supposing, for instance, that two engines cost $1,500 and $2,000 respectively, that engine No. 1, which cost $1,500, will return 5½ per cent of its coal consumption. Engine No. 2, which cost $2,000, will return 6½ per cent of its coal consumption. Both are 50 horse power engines. According to good practice engine No. 2 should require about 3½ pounds of coal per horse power per hour. Engine No. 1, on this basis, would require 4 1-9 pounds; or engine No. 2 would consume 175 pounds of coal

per hour; engine No. 1 would consume 205 pounds per hour, a difference of 30 pounds. At $5.00 per ton, this would mean 7½ cents per hour; running ten hours per day, 75 cents; 666 days, $500. This means that in buying the cheaper engine payment for the better engine in full has been deferred at most two years, and then the extra cost for coal alone would buy the better engine now every eight years. A very similar argument applies to the horse. The extra cost of keeping a poor horse to do a given service over and above the cost of keeping a good horse to do that service will in a comparatively short time amount to more than, not only the difference in first cost, but the entire cost of the good horse at frequently recurring intervals.

What has just been said about the "sources of power" applies to the machines which intervene between the source of power and the work of that part of the energy which the "prime mover," or "source" delivers to the machine, whether it be a mower, a header, a plow, or a wagon; only a portion is turned into useful work, the rest is wasted. It is of the highest economic importance that this wasted portion of the energy be made as small as consistent. Let us do a little more figuring to see what our power costs us. Assume that a good horse, which we have just seen is the best horse, costs $150.00; that he will eat 600 pounds of hay per month at $7.00 per ton; that he will eat 200 pounds of grain, at $1.50 per cwt., per month; that it will cost $1.00 per month to keep him shod; and that his period of usefulness is 10 years. Then in ten years we should have charged up to that horse's account $1,134, or say even $1,200, since we have not counted cost of caring for the horse. If now we may count on a 10 per cent per annum profit on the money expended the account would be increased to $1,875. In other words the service of the horse, if he be a profitable horse, should be worth $187.50 per year. A draft horse of good timber will walk about two miles per hour, exerting a continuous effort equal to about 1-10 of his own weight for 8 hours a day. A 1,500 pound horse will, under these conditions, produce about 5-6 of a horse power of work. One horse power then costs $225.00 per year for an 8 hour per day service. These figures are conservative and based upon facts of direct observation. Incidentally it may be noted that electric power is at present being sold in the markets of this State at $50.00 per horse power per year. The farmer pays about 4½ times this price for

power on his farm. The point is that horse power on the farm is very costly, and that the farmer pays for every unit that he uses whether he realizes it or not. The cost of power is the chief item in the cost of running the farm machinery. Assume that one mowing machine costs $60.00 and another $40.00, the only difference being a difference in draft. Let us say that the $40.00 machine requires a pull of 300 pounds, the $60.00 machine requires a pull of 280 pounds to do the same work. The difference in power amounts to a little more than 7 per cent. If we assume 300 working days per year for a team; then 7 per cent of $1.25, the cost of a team per day, is 8.7 cents, or the extra cost for pulling the heavier machine. Now assume that the entire life of the machine is 1,000 days. The extra cost for power will have been $87.00, the saving in first cost $20.00. Thus the cheaper machine will have cost $67.00 more than the better machine, or the cheaper machine has cost as much as two good machines and $7.00 more. Enough has been said to emphasize the fact that what appears at first sight to be a considerable difference in first cost of a good article and a poor one very soon vanishes, and that in every instance the poor article becomes the more costly.

So far we have considered only the question of draft. Two other very important items must be taken into account in the consideration of the general efficiency of a machine. These are the grade of work done, and the durability or life of the machine. If it is a hay mower, it is not enough that the draft is as light as consistent but that its cutting apparatus is such as to give the best practical results. The assumption is that the farmer wants to cut all the hay on the field gone over and not cut three-fourths and have the remaining one-fourth for pasturage. It requires no argument to show that it would be the very poorest kind of economy to cut one acre of land for one ton of hay if with a better machine one ton of equally good hay may be cut from three-fourths of an acre, whether the remaining fourth be pastured or wasted. If it be wasted then there is a double loss. Put the waste as low as you please, convert it into dollars and cents and the result will be that a machine which does low grade of work will do more than its full share to keep a farmer poor. The other item which has to do with the life of the machine is really of secondary importance, for even if two machines are in every respect equal except that the total life of one is only one-half that of the other,

the difference is only *once* the first cost; while as has been seen, if they differ only slightly in either the power required or the grade of work done, it will in the life time of the machine amount to several times the first cost.

The real purpose of the paper is to point out to what extent the farmer may keep this waste and consequent decrease in profits as low as possible. What the farmer may do to improve the source of his power will be passed by. The writer is incompetent to discuss the relative merits of the horse as a prime mover, and what is said below will apply in general to the steam engine as well as to the regular farm machinery. Until the machine comes into the farmer's possession his only chance to exercise his judgment in the interest of economy is in the selection of the machine. If he is governed by price only, he usually makes a mistake. Reliable experiments on the performance of farm machinery are almost wholly lacking, hence only the general opinion of farmers themselves may be used as a guide in the selection of machinery.

After the machine comes into the possession of the farmer, however, he may do much to keep down the expense of running. And also to control the grade of work done as well as to increase the life of the machine. The expense of running is directly proportional to the draft. The draft in turn depends upon the friction and the work. The friction may be reduced by keeping the running parts of the machine free from dirt, grit and other material that may interfere with the free movement of the parts. It may be still further reduced by keeping all rubbing surfaces well lubricated with a suitable lubricant. Very frequently a quarter or even a half dollar per gallon extra for lubrication in either quality or quantity, will save a hundred fold this difference in the cost of the power required. The limits of this paper will not permit of a discussion of the grades and qualities of lubricants for different purposes. The general rule is that the lubricant should be adopted for speed and pressure between the rubbing surfaces.

Heavy pressures and slow speed require a lubricant with plenty of body; higher speed and lighter pressure, a lubricant with less body and more fluidity. Thus according to the variations lubricants are used, varying from the heavy greases to the light mineral oils, vegetables oils, such as linseed (rape seed or cotton seed oil are not suitable for lubrication on account of their drying qualities). Animal oils, and greases—tallow, lard-oil,

neatsfoot oil, etc.—are good lubricants as long as they are kept fresh. They are very apt to become rancid, however, and in this condition they become very injurious to the bearings on which they are used. Rancidity means the formation of organic acids which attack the metals, eating into their surfaces, making them rough and thereby increasing the sliding friction.

The draft of a machine may be still further reduced by keeping the machine in good repair and proper adjustment. The working parts must be kept in that condition which will enable them to do their work with the least possible resistance. If it is a mower or a harvester, the cutting apparatus must be kept sharp, the bearings must fit, not being either too tight or too loose, and rubbing surfaces must be kept smooth and even. An hour or two spent by the farmers occasionally in removing all dirt and foreign matter, including dirty grease adhering to the moving parts, tightening up nuts and burs, cleaning and possibly draw-filing bearings, etc., etc., will more than pay for the time lost in looking after their machinery. These matters are important and mean many dollars to every farmer who uses machinery of any kind. But even more important than this is the care of the machine when it is *not* in use. It is a remarkable fact that all over this region farmers have their machinery and tools exposed to the weather from the time they get through using them in the fall till the next summer, when the season again opens. It has been estimated by competent authority that a farm machine will deteriorate at least fifteen per cent by wintering out one season. Every machine and every tool should be housed as soon as its outside service is ended. It should be sheltered from moisture and, unless the ground is very dry, should be put upon a floor. It should be thoroughly cleaned and all bearings and finished metal surfaces should be given a coat of good, clean oil. A new coat of paint should be applied to all exposed parts. If they are wooden parts they must be perfectly dry and in every case free from dirt. It depends largely upon how the machine has been wintered as to how much power it will require to operate it the following year, so here again the farmer not only pays for the deterioration of the machine, but he makes an extra draft on his bank account for driving power the next year. It *pays* to take care of your machinery whether in use or at rest.

Woman and the Home.

By D. Cotey, Utah Agricultural College.

For many hundreds of years much has been written and spoken in regard to woman's place and woman's work in the world, and nearly all writers and speakers in all ages have given expression to the same belief, namely, that woman's place in the world is in the home and woman's work is to direct the interests of the home and care for its inmates. Away back in the old Bible times the ideal woman was described as the one who "Looketh well to the ways of her household and eateth not the bread of idleness."

That woman in general accepts without question the oft-repeated statement that home is the true sphere of the true woman and believes it in her heart of hearts cannot be doubted in spite of the fact that some women claim that other spheres seem broader and more pleasing to them. The majority of women accept the home and its duties as their birthright and should they exchange it for other duties in other fields of work would feel that they had indeed "sold their birthright for a mess of pottage."

Now, in saying that women in general rejoice in the fact that the home is their sphere, let us see if we understand just what we mean by that expression. Do we mean that woman's duty is in the home and that she is to have no interest in ought outside its four walls? Would we return to the belief of olden days that a woman should leave her home but three times, during her life time; once to be christened, once to be married and once to be buried? Do we mean that woman should have no knowledge other than that necessary to the performance of home duties? We cannot possibly read any such idea into our belief in our right to the home. Woman is, first of all, a human being, and has the same right that any other human being has to develop to her utmost the mental powers and faculties given to her by her Creator. Do we not rather mean when we say that woman's sphere is the home, that she is to gather knowledge and wisdom from all sources and apply it in making better the conditions of the home.

We say that no other field of work has duties so important,

responsibilities so great; that no other line of work calls for such untiring devotion; and we believe it and enter into our home life feeling that we have the noblest calling whereunto any human being can be called.

That is well and as it should be, but do we carry that exalted ideal through the years that follow? Do we not gradually lose our enthusiasm and our interest in the management of home and come to regard its life as monotonous and its every day duties as commonplace or as mere drudgery? This should not be. Of all workers the wife and mother in her own home should feel an ever increasing interest and joy in performing the duties that come to her. We are, however, compelled to admit that this ideal feeling exists in the exceptional cases only and that the majority of home-makers continue the routine of the home life from force of habit and through force of circumstances, instead of for joy in the doing.

We say that this is the existing condition, but why should it be so? Does not the man feel a constantly increasing interest in his profession or business or particular kind of work? Do we hear the doctor complaining that his work is monotonous, or the lawyer talk of the drudgery of his profession, or the merchant bewail the fact that his business brings a similar routine day after day? The farmer enters upon each season's work with renewed zeal and upon each succeeding year with the determination that the crops shall be better and more profitable than those raised in any preceding year.

Why does not the woman feel likewise in regard to her life work? If we view the situation carefully we will find that there are many reasons why woman does not feel that increasing interest in her profession that man does in his, and two of these reasons may present themselves with special force to our minds.

The first one is that woman does not regard the keeping of the home as a profession and does not properly prepare herself to enter upon its duties. The second reason is that she does not believe that there are newer and better ways of managing the home and doing its work than those she uses and so makes no effort at improvement or to learn what science has done in her behalf.

In regard to the first reason, surely home-making with its varied and responsible duties can be accorded the dignity of a profession. In fact is it not many professions in one? There is

the profession of housekeeper, the one who directs the financial expenditure of the house, cares for the supplies and gives them out, plans and directs the work, and sees that others properly execute her plans. This work alone is given generous pay in large cities. Cooking is another profession and one that can command its own price. A high degree of skill in the culinary art brings higher pay than any of the learned professions and almost equals in amount that received by the chief executive of the land. The home-maker must understand laundering in all its details, and that is another of the professions or trades. She must understand all kinds of sewing from patching and darning to fancy dress-making, and even art needlework and any one line of such work is a lucrative profession. The home keeper must often be nurse, and caring for the sick has now been raised to the dignity of a profession worthy of the best women in the land. The housekeeper is often of necessity teacher, and gives the little ones their first years of instruction before they enter the public schools. Household manager, cook, laundress, seamstress, dressmaker, nurse and teacher, to say nothing of the sacred duties of wife and mother; are these duties not sufficiently varied and important to require special preparation for their performance?

In what other profession would an individual be allowed to practice without experience, without training or knowledge? What business man would employ some one to direct his affairs who did not know by actual experience every detail of the work that he had to oversee?

How often we hear the opinion expressed that a woman learns housekeeping by instinct; that any one can keep house. But the woman and the one who shares her first housekeeping knows that this is not true, but that she learns to do well through oft-repeated and discouraging failures. And is it not by reason of these many failures that so many women lose their interest in the work of the home.

No one will question the statement that the average young woman does not have the training necessary to enable her to carry on the varied duties of the home in a satisfactory manner. Not knowing the best methods of doing work she labors unnecessarily hard and this fact, together with the unsatisfactory results of that labor, renders her discouraged and dissatisfied with her home life.

The second reason given why women come to feel that home life is monotonous, and its duties drudgery, is that they are satisfied with their own ways and methods, and do not try to learn newer or better ones. Here again woman's duties differ from man's and to our disadvantage. Man learns of a new way and tries it to see if it will be of value to him; woman condemns the new way as useless, without trial, and insists that her own way is good enough. Does she not sometimes say "My mother did that way" or "Our folks always did so," proof conclusive that there could be no better way.

Now what can be done to overcome these two undesirable conditions, lack of preparation and failure to appreciate better methods? The lack of preparation for the duties of the home should be overcome before the young woman enters upon those duties by thorough training and practice in every detail of home life. How is she to receive this training? That she should receive it from her mother seems the natural way and gain her experience by helping in the daily work of the home. She presupposes that the mother is capable of giving this training in the best way and that the daughter has plenty of time to gain her practical experience. It is seldom, however, that either of these conditions is met. Many mothers are excellent housekeepers themselves but do not have the ability or disposition to impart that knowledge to their daughters; neither does the average young girl who is attending school regularly have time to spare from her lessons to become proficient in housekeeping. By helping her mother all she can she gains much practical knowledge, but does not acquire the ability to properly plan and execute the work. If the young girl is to receive her preparation for housekeeping at home, will there not have to be some change from the usually existing conditions?

How often we hear mothers complain that their daughters take no interest whatever in the home and are not willing to share its duties. May not the reason for this be some fault in the mother's training rather than in the girl's disposition? The *little* girl is so eager to help mother. Why should she not continue to be so? Mothers say that as soon as the girl learns to do something *well,* well enough to have it of real help, she is tired of doing it. True, but does she not want to learn something else, something a little more difficult, more like grown-up people's

work? If the girl is allowed to share in such work and gradually is given the entire responsibility in one line and then in another, she will not lose her interest in the every-day duties of the home, will take many a burden from the shoulders of the busy mother and will be acquiring training and experience for her own life work.

On the other hand mothers often say to the daughter who is anxious both to learn and to help, "Oh! don't bother me. I can do it myself easier than I can show you," or "No, you can't do it, you will spoil it," or "Run away. I can do that quicker than you can." These mothers forget that they owe a duty to the future to properly train their girls who are to be the housekeepers of tomorrow.

There are many things besides the practical duties and management of the home that the girl should be taught that will make her work easier for her, far more interesting, and more satisfactory in its results, viz. the composition of foods, the ways in which they nourish the body and underlying principles of cookery. These things the mother cannot teach her because she does not understand them herself. They were not taught when she was a girl and she has had no opportunity to learn them since.

Then for this knowledge, so necessary to the best home making, the girl should go to some school where she can take a thorough course in domestic science at the same time that she is gaining her general education. Then she will return to her home with greater interest in its duties and a desire to put into practice all that she has learned. So we see that the mother, the home and the School of Domestic Science must work together to train the mistress of the ideal home of the future.

Now how can the mistress of the home of today be helped; how can she gain a new interest and enthusiasm in her daily life and duties? By learning something new? Let us see. Every housekeeper realizes that the kind of food that she provides for her family has a very important part in their physical development and general health, but not every one understands how this is, or why. Not every housekeeper understands the composition of foods or how they nourish the body. The farmer thinks it very essential to understand the amount of nutriment in the food he gives his stock and whether it is food that will produce muscle or fat, and figures out carefully just the amount of food

required to keep his animals in the best condition. Is it not vastly more important for the housekeeper to understand the nature of the food she gives her growing children, especially when the physiologist tells us that the quality and quantity of the food eaten affects not the physical condition alone of the individual but the mental and moral condition as well? Now if the housekeeper can gain a little knowledge from books and magazines about foods and their comparative value and their uses in the body, will it not renew her interest in cooking and planning meals; and will she be so apt to complain of how tired she is, trying to think what to cook for breakfast, dinner and supper day after day? From her reading the housekeeper will learn that when she feeds her little prattling child chiefly upon potato she is giving it food that produces fat but contains little to give it strong muscles. She will learn that fat pork and fried foods for growing children will not give them good blood and clear brains. She will learn that children will be better tempered, less peevish, fretful, and quarrelsome if given more bread and milk and less meat and hot rolls. These and many other facts she will learn that if put into practice will add to the health and happiness of her family. There are principles of cooking, new preparations and combinations of food that the housekeeper can learn that will enable her to set a better table with a greater variety of food and for less money than she now spends.

Then there is sanitation—the study of the healthfulness of the house and its surroundings. There are many books and articles in magazines written upon this subject that the housekeeper could read with pleasure and profit. Hygiene is a subject that is always interesting to women. A great deal that will be helpful in caring for the sick can be learned from books and magazines.

Methods of doing house work to economize time and strength, ways of caring for household stores, wise and economical marketing—upon all of these subjects the housekeeper can find many new and valuable suggestions in the variuos household magazines.

The United States government employs some of the ablest chemists in the country to work with foods, to analyze them, to find out the composition, and then to cook them in different ways to determine the method of cooking that will render the food most nutritious and digestible. The Government spends thousands

of dollars each year upon this kind of work, and the information thus obtained is printed in bulletins and distributed free of charge to those who desire them. If the Government thinks it worth while to expend so much money in order to benefit the housekeeper, ought she not to take enough interest in such subjects to send for these bulletins and read them?

The busy housekeeper has but little time for reading, it is true, but a few minutes a day, an hour or two during the week, would not be missed from the general work of the house, and if spent upon the right kind of reading should bring much pleasure to the housekeeper and many blessings to her family. Many women will say that they cannot spare the money to buy books and to take magazines. It is true that the average housekeeper cannot afford to have a library of books on foods and housekeeping, but one book purchased during the year and carefully studied will give many helpful ideas. If a few friends and neighbors will each buy a different book and then exchange with each other, the reading of a number of books can be enjoyed.

There are several excellent housekeeping magazines published at the very moderate price of one dollar a year. These give a great deal of very valuable information to the housekeeper and as a new number comes each month fresh interest is always awakened.

Now, as we always take greater interest in the things that we share with others, if the housekeepers will meet together for an occasional afternoon or evening and talk over the new ideas they have gained from the books, magazines and bulletins, tell of their experiences in trying new methods and exchange opinions as to their practical value when applied in their homes, I am sure they will all agree that they have never spent pleasanter or more profitable hours, and will gladly acknowledge that this little effort to gain some of the facts taught in the domestic science schools and to share some of the discoveries of science has been of inestimable value to themselves and their homes.

Reading for Children.

By M. E. Wyant, Utah Agricultural College.

The old saying, "Take care of the dimes, and the dollars will take care of themselves," is no more true or valuable in regard to financial matters than is the more modern one, "Take care of the child's reading, and the young man's or young woman's will take care of itself," in regard to the intellectual and moral life of an individual.

What I shall say on the subject of "Reading for Children," I shall say not as a theorist, as one who has woven a beautiful web of idealism out of delicate threads of fancy, but as one who has always been associated with children, large and small, both in the home and in the schoolroom, and who, through sympathy with them in their work and play, and, especially, in their reading and studies, has, by observation and by experience in training them, learned many useful lessons as to what they like, need, and what they must have, if they are going to be truly wise, useful, and happy men and women.

It is not a difficult matter to determine what children like, when up from the child's cot and even from the cradle comes the universal cry for a "story," and frequently the tired and busy mother considers it fortunate if the little one is satisfied with but *one* story. The child dearly loves a "story." It is natural for him. He is in that period of life when the imagination is developing, and needs nourishment. His longing for stories is merely nature's demand for intellectual food and should be supplied, I believe, with as much care and regularity as is his physical food.

The child likes the fanciful—the myth, the legend, the fairy tale—and his little mind thrives on this sort of food as his body does on bread and milk. I know there are people who object to this class of stories because they *are* fanciful and unreal. But are they an injury to the child? Who today considers his parents false teachers because of the Santa Claus myth? Should we not rather like to pass through the sweet delusion again? And could we be heartless enough to deny the little one such joy as the mythical Santa brings him? The best of our legends, myths, and

fairy tales have similar effect upon him. Little Red Riding Hood is as real to him and makes as deep an impression upon his mind as Santa Claus does, and Santa is as real, while the secret is unrevealed, as ever George Washington could be. It is the life, the action, the unrestrained movement in the story that makes it popular with the child. The so-called "true story" and the "goody-goody" story, too often found in our Sunday School libraries, will, because of the action in them, satisfy him for a time, but he soon tires of the unnatural conditions and of characters so untrue to the life he knows and frequently either ceases to read, or, in his endeavor to find something more in keeping with the world about him, he takes up with an equally bad or worse type of literature.

To prove that these desires of the child are natural, we have only to turn to the pages of history. The nation reflects the individual. The earliest periods in the life of a nation reflects childhood's happy hours. It is the story-telling time—the time that has given the great national epics to the literary world. But for this childlike period in the nation, many of our greatest poems today would never have existed.

We have seen what the child likes. We shall now consider what he needs and how those needs may be supplied. In the first place, he needs to read more and better books than the average child does; if not *more* books, at least, better ones. This need of better reading is very clearly shown in his English work in school. The child who reads little or nothing outside of his text-book finds his study of English difficult and often uninteresting. He cannot appreciate the use of grammar; he sees no value in compositions because he hates to write them; he is unable to interpret literature readily and, therefore, cares but little for it and never gets the best there is in it. On the other hand, the child who reads good literature in connection with his school work has a better choice of words, more thought, is quicker and more appreciative, and is able to express himself both orally and in writing with more freedom and ease, with more interest and pleasure.

This difference in children is readily seen in their letter writing. I have in mind two little girls who were in about the same circumstances except that the one was encouraged in reading what few books she had, and the other was not. Both went to school and both were bright girls, but the one who formed the reading habit could write an attractive letter, with correctly

spelled words, good punctuation, and interesting thoughts well expressed. The other child could write only of the simplest and most common-place events in a very crude, ordinary style, with no unity of thought or ease of expression.

Unless a child is born with a taste for reading, he is never going to have it without some external stimulus. In the first place, he must have books—books suited to his age and disposition, books in which he is likely to become interested. But this may not be enough. He may need to hear them read in the sympathetic voice of a mother or in the wise tones of father before an interest can be awakened in him. Sometimse a temporary stimulus in the way of a prize offered for a certain amount of reading in a given time will accomplish the purpose and form a permanent reading habit. I recall a boy of fourteen or fifteen years of age, who was thus induced to read. There were plenty of books around him, both his own and those of the family library, but he preferred the stories of the village loafers to those in his books, until a contest was arranged between him and his brother, and a prize offered to the one who should read the most pages in a given time. At first the reading was done mechanically and rather laboriously, but before many weeks had passed, the lad volunteered the information that he was not reading any longer for the prize, but because he liked to read.

Boys and girls need to be kept at home, not by force, nor through duty or necessity alone, but because they appreciate home and prefer it to the street, the public house, or even to their neighbor's home. The term home, such a home as is worthy of appreciation, does not imply a stately residence, rich furnishings, and great wealth, but, I believe, it does imply a glowing fire, a bright light, a table spread with good books and papers, and interested and sympathetic readers or listeners in father and mother. This is, after all, worth more to the boy and girl than all they can get outside of the "home nest." As Scotland's gifted poet says,

> "From scenes like these old Scotia's grandeur springs,
> That makes her loved at home, rever'd abroad."

And it is from such scenes as these that the greatest and best men and women of our own country have come and are destined to

come in the future. Cultivate in the boy and girl a taste for good reading and furnish them suitable literature with which to gratify that taste, and home will be vastly more to them than a mere boarding place or a lodging house.

But how shall our obligations to the child be fulfilled? How shall his needs be supplied? In attempting to answer these questions, I must say that I am heartily in sympathy with Edward Everett Hale and others, who advocate turning a child into a large and well-selected library "to browse about" and find for himself what he needs, but I realize that not many children can have such ideal opportunities, and so, great care must be exercised in finding a proper substitute. In the country or small town where there are no school or public libraries, the entire responsibility of supplying the child's neutral needs rests upon the home; and the home library is, after all, the best source for his supplies. It is said that Abraham Lincoln sometimes walked forty miles to satisfy his desire for reading material, but according to my observation, we have few Lincolns today and would secure far better results from our boys by furnishing them a small library at their own fireside.

The dearth of reading material in many homes is often due, not so much to a lack of means or to an unwillingness to provide books, as it is to an inability to make a proper selection. Not knowing just what to buy and wishing to make no mistake in their choice, parents often make the greater mistake of choosing none. One can scarcely make a mistake today in choosing books for children, if he will select them from our standard English and American authors—books that have stood the tests of time and of criticism. Such poets as Homer, Shakespeare, Milton, Scott, Wordsworth, and Tennyson; or Longfellow, Lowell, Holmes, Bryant, Whittier, Eugene Field and James Whitcomb Riley; or writers of fiction, such as Dickens, Scott, Thackeray, Eliot, Kipling, Hawthorne, Cooper, Louise M. Alcott, Jane Andrews, and Kate Douglas Wiggin are not out of place on any book-shelf. These are at least, sure to be safe. Too many recent books are not worth reading at all. Popularity is not always a good criterion. Sometimes the most popular work is mere trash and soon passes into oblivion. Our standard, then, for judging new books and those we have not read must be either the judgment of some friend in whose ability we have confidence, or of some established

book reviewer. The habit of reading book-reviews, such as are furnished by many of our monthly magazines, is, I believe, a good one for most of us to form.

The remarkable cheapness of many of our standard works today puts every one within easy reach of at least a few of the world's masterpieces. If they cannot be found in the home book-store, or if we live too far from a book-store to get our supplies from it, we can get what we want easily and safely through the mails. A number of firms in New York, Chicago, Boston, and Philadelphia, and in other places have their mail order departments and gladly fill orders. Almost any book desired, from the cheap board cover editions to the most expensive illustrated ones, may be obtained through A. C. McClurg & Co., Chicago. I have seen some very satisfactory editions, ranging in price from twenty-five cents to a dollar and a half, obtained from Montgomery, Ward & Co., Chicago. Almost any of our standard Young People's books may be obtained from the Altemus' Publishing House in Philadelphia, at from twenty-five to fifty cents a volume. These are only a few of the many reliable publishing houses. Nickels and dimes saved by the boys and girls and invested in good books is reliable capital stock, which brings in large returns.

When shall the child begin to read? This is another question often asked. The earlier he forms the reading habit and acquires a taste for good reading the better. The sooner the child becomes acquainted with great souls through great thoughts, the sooner he will have noble ideals and the more likely he will be to choose good companions. When he is with a good book, he is in good company, and when he has once discovered this, he will not readily exchange it for that which is bad.

Then, let his reading begin in the cradle. More than one child has received literary inspiration and love for poetry while in the cradle. The child likes anything that is rhythmical, whether lullabys, Mother Goose rhymes, songs, or ballads, and I doubt not that the music of Longfellow's Hiawatha might soothe his spirits and delight his rhythmic loving soul as much as some of the jingles with which he is too often obliged to be contented. Sir Walter Scott was often entertained and lulled to sleep by the wild, free music of the border ballad. This, together with a similar kind of entertainment provided him a few years later by his doting grandfather, no doubt helped to furnish inspiration for his Mar-

mion, The Lady of the Lake, Border Minstrelsy, and perhaps for some of his great novels. Read to the children until they are old enough to read for themselves and they will gladly pay back the time in later years.

The child should not be kept too long on "juvenile" literature. There is great danger in that. He needs a gradual increase in the strength of his mental diet even as he does in his physical food. Do not fear the meat of literature. He may not be able to assimilate simplified Bible stories, he has come in touch with the Biblical heroes as he never could have done with the Bible itself; books on nature study have revealed to him many of Nature's mysteries and brought him into closer sympathy with her works; stories of animal life have made him more tender and sympathetic and have taught him to consider all life precious; historical, biographical, and geographical stories have extended his mental horizon and made by-gone ages and people, and far-away places like present realities; stories of adventure have awakened in his heart a desire to do heroic deeds; while poetry has softened and beautified, and spiritualized his harsher, rougher nature. What more does he need?

It seems that all this should suffice even the most fastidious and yet it does not. The child wants besides something bright, fresh, and new, something wholesome and healthful coming every week or month, like the welcome face and cheery voice of a beloved playmate or friend. He needs a weekly paper or monthly magazine, such as the Youth's Companion or St. Nicholas, whose pages breathe forth cleanliness, purity, and health. These papers are, as yet, too little known in the west. They are wholly non-sectarian and are cherished by all who read them. I once heard a city superintendent of schools, a man past middle age, say that he read The Youth's Companion regularly in order to keep young and in sympathy with his pupils. If the home is supplied with clean, ennobling books and papers, and the child taught to read them, he will have neither taste nor time for "yellow-backed literature" or for cheap trashy story papers such as hold out the offer of poorly colored chromos as an inducement to get their spurious, sensational literature into our homes.

"Tell me what a man reads, and I will tell you what he is," says one writer; and since it is true that what we read reflects itself in our minds and characters, we should exercise the great-

est of care in the selection of reading matter for the home. In the words of James Freeman Clarke, "Let us thank God for good books. When I consider," he continues, "what some books *have done* for the world, and what they *are doing,* how they keep up our hope, awaken new courage and faith, soothe pain, give an ideal life to those whose homes are hard and cold, bind together distant ages and foreign lands, create new worlds of beauty, bring down truths from heaven—I give eternal blessings for this gift, and pray that we may use it aright, and abuse it never."

Utah - Agricultural experiment station

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EXPERIMENT STATION

OF THE

AGRICULTURAL COLLEGE

OF UTAH

Bulletin No. 97

Fig. 1.—Prune Orchard on the Southern Experiment Farm.

REPORT ON THE SOUTHERN UTAH EXPERIMENT STATION

DECEMBER, 1906
LOGAN, UTAH

TRIBUNE-REPORTER PRINTING CO.
SALT LAKE CITY, UTAH

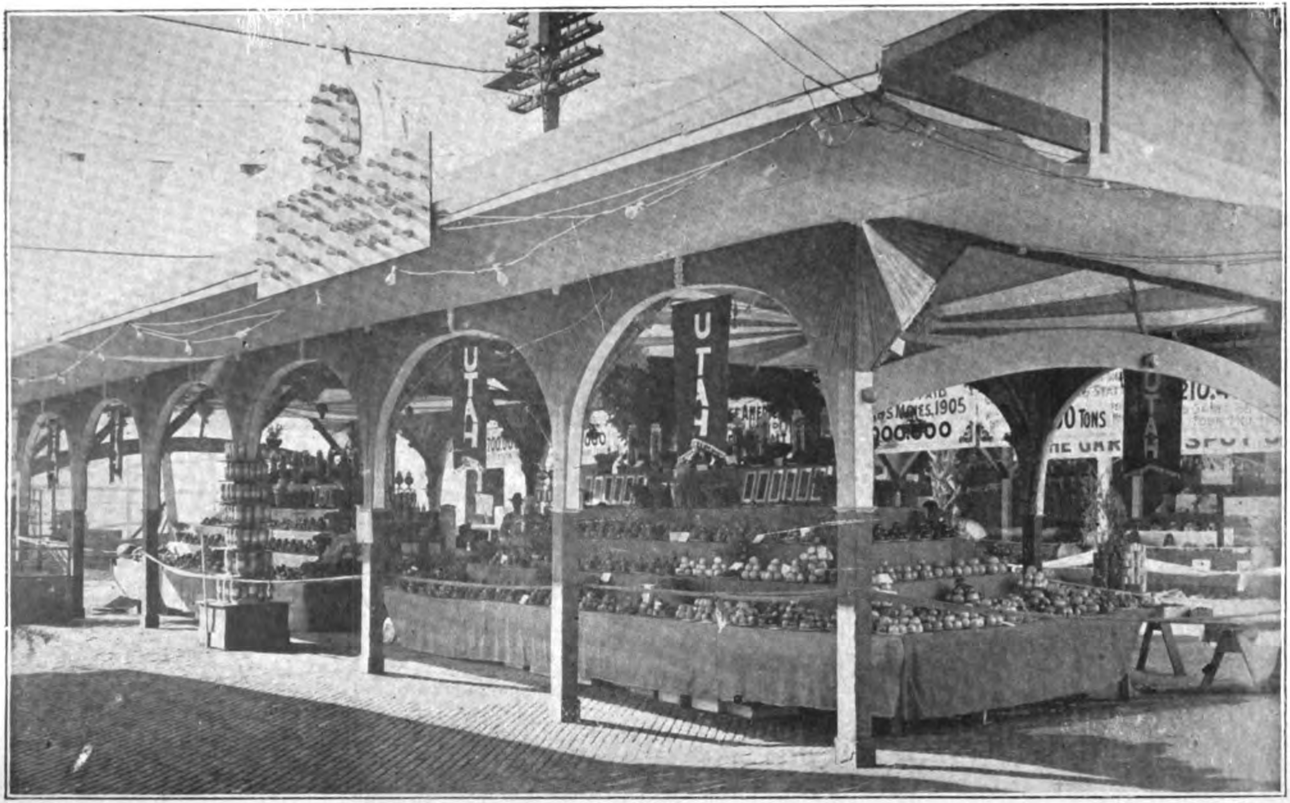

Fig. 2.—Utah Exhibit at the National Irrigation Congress, Boise, Idaho, September, 1906. Part of the Exhibit was from Washington County, and the Southern Experiment Station was very helpful in making this display and in winning honors.

Fig. 3.—Vineyard on Southern Experiment Station composed mostly of Resistant Vines. Workmen's cottage and barns in background.

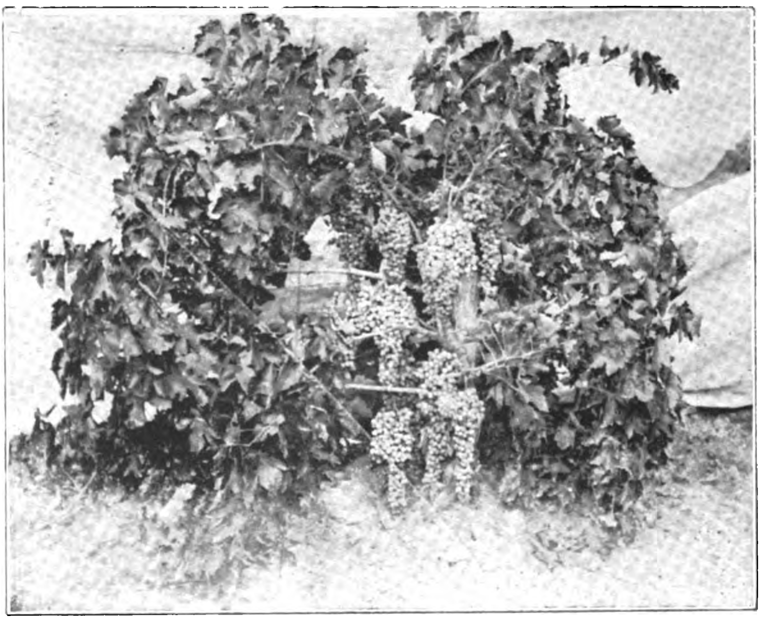

Fig. 4.—Thompson Seedless Grape Vine. This vine is on its own root and is three years old.

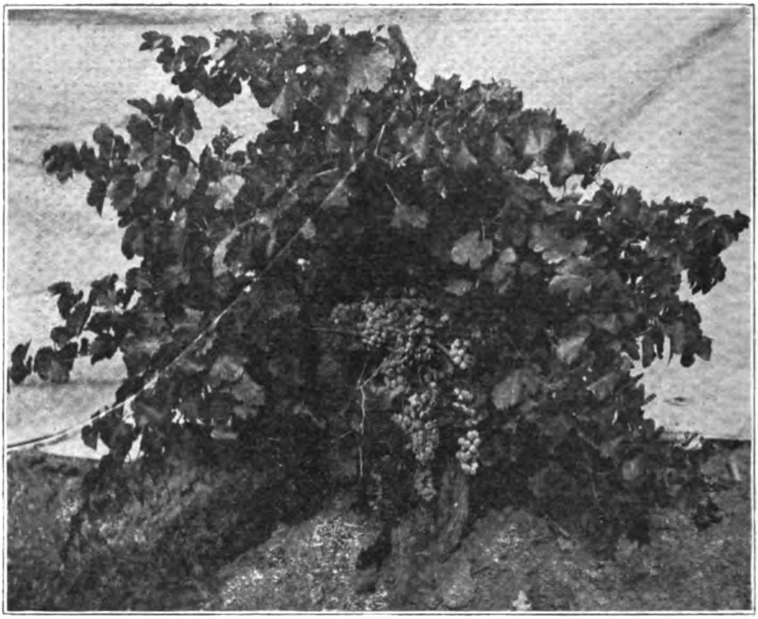

Fig. 5.—Black Ferrara Grape Vine. This vine is on its own root and is three years old.

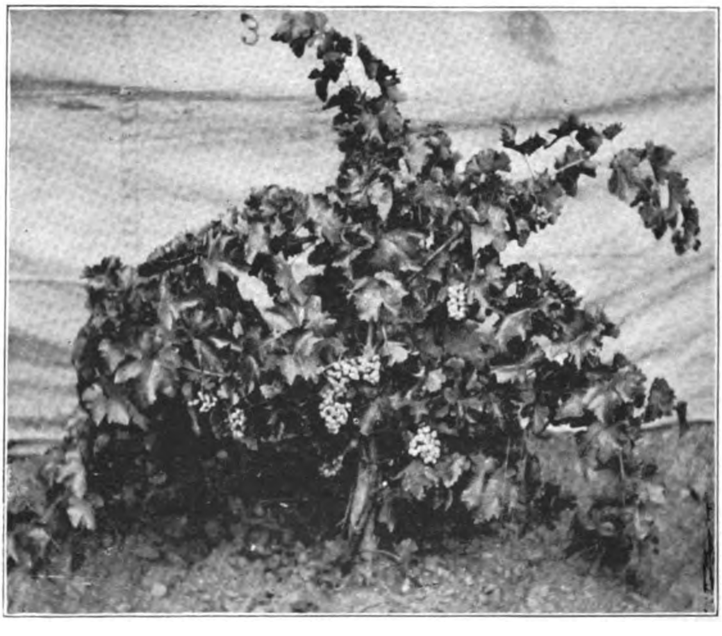

Fig. 6.—Emperor Grape Vine grafted onto Rupestris St. George. One season's growth on root two years old when grafted. All of this growth came between June 1st and Sept. 18th.

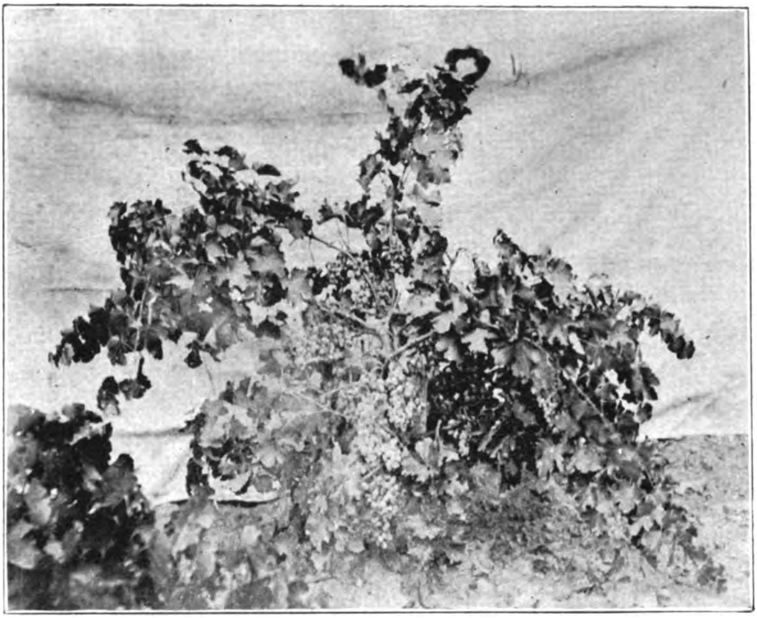

Fig. 7.—Cornichon Grape Vine on its own root. Two seasons old.

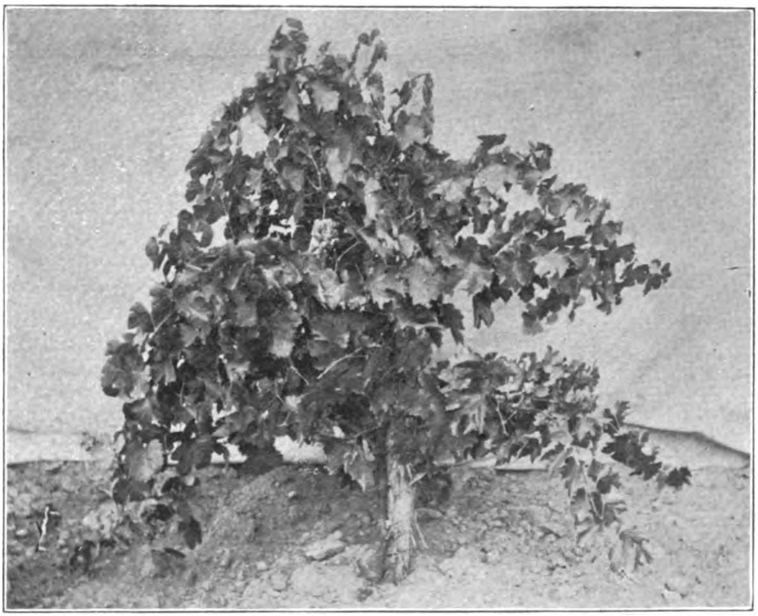

Fig. 8.—Cornichon Grape Vine grafted to Rupestris St. George. One season's growth on a root two years old when grafted.

The Agricultural Experiment Station of Utah

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The Bulletins will be sent free to any address in the State, on written application to the Experiment Station, Logan, Utah.

INTRODUCTION BY THE DIRECTOR.

P. A. Yoder.

In January, 1905, the Legislature of the State of Utah passed an act entitled, "An act providing for the establishment of a Central Utah Experiment Station, and placing the same, with the Southern Utah Experiment Farm, under the direction and management of the Agricultural College Experiment Station of Utah, and repealing Chapter 85, Laws of Utah, 1899." The provisions in full of this act are as follows:

"Be it enacted by the Legislature of the State of Utah:

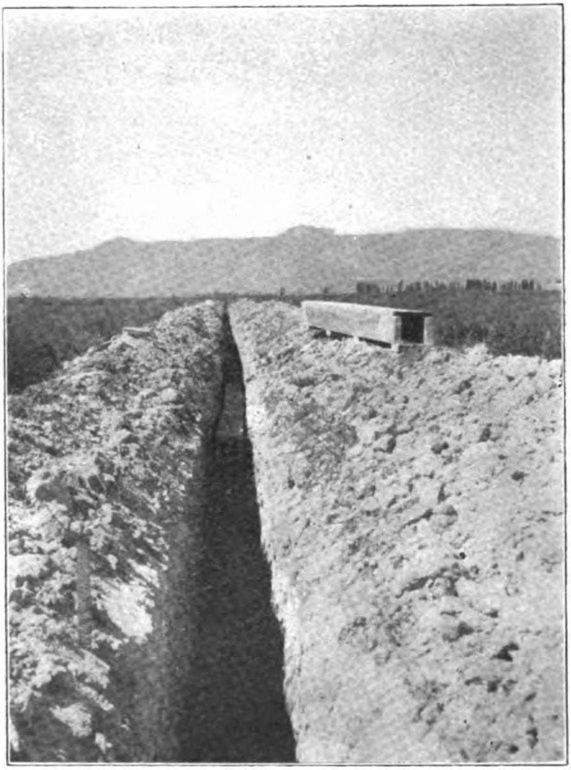
"**Section 1. Central Utah Experiment Station Established.**—An experiment station, to be known as the Central Utah Experiment Station, is hereby established. This station shall be a branch of the State Experiment Station established as a department of the Agricultural College of Utah.

"**Sec. 2. Southern Utah Experiment Farm.**—The Southern Utah Experiment Farm, located near St. George, Washington county, is hereby made a branch station of the State Experiment Station established as a department of the Agricultural College of Utah.

"**Sec. 3. Class of Experiments to be Conducted.**—Such experiments and demonstrations are to be undertaken and continued on the said stations and farms as bear on the development of the agricultural and horticultural interests of all sections having climatic conditions similar to those prevailing at the sites of the said stations or farms.

"**Sec. 4. Central Station, How Located.**—The location of the Central Utah Experiment Station shall be determined under the supervision of the director of the experiment station, together with the State Board of Land Commissioners and the Board of Trustees of the Agricultural College, in Davis, Salt Lake, Utah, or Weber counties.

"**Sec. 5. Site to be Furnished.**—The county or counties in which the station mentioned in section 4 is located, shall furnish to the State a clear title to sixty acres or more of good land, with



DRAINAGE EXPERIMENT.

Box Drains in Outlet Ditch, Geary Tract, Huntington, Utah.

REPORT ON IRRIGATION AND DRAINAGE INVESTIGATIONS DURING 1905-1906.

By W. W. McLaughlin.

INTRODUCTION.

A general plan for the scientific investigation of the laws governing plant production as influenced by the application of irrigation water, was outlined in 1900 by Dr. John A. Widtsoe as Director of the Utah Experiment Station. The detailed plans were prepared by the heads of the Chemical, Agronomy and Irrigtion Department, under whose cooperation the work was to be carried on. In 1903 the Office of Experiment Stations of the U. S. Department of Agriculture, by contributing funds to this work, became a party to the experiments. Since then the investigations have been under the joint supervision of the State and Federal governments. In the spring of 1906, the State Engineer, Hon. Caleb Tanner, became a party to the irrigation work in Morgan and Weber counties.

During the season of 1904 the Drainage Expert of the Office of Experiment Stations and the Irrigation Engineer of the State Station made investigations upon the requirements for drainage throughout Utah, and during the same fall installed a drainage experiment in Cache County. As a result of the investigations and the favorable outlook for the drainage work instituted, it was decided to undertake drainage experiments in addition to irrigation work. During the past two years drainage has been an important part of the investigations of the Experiment Station.

The present bulletin reports the investigations in irrigation carried on in different sections of the State other than at Logan and the results of the drainage investigations. The plans for this work were outlined for 1905 by John A. Widtsoe and W. W. McLauglin of the Sate Station, Elwood Mead and C. E. Elliott of the Office of Experiment Stations. The plans for 1906 were outlined by the Director and Irrigation Engineer of the Station, and the State Engineer, representing the State; the Chief of Irrigation and Drainage Investigations, and the Drainage Engineer representing the U. S. Department of Agriculture. The field work in Irrigation and drainage was conducted in 1905 by E. R. Morgan and C. F. Brown respectively. In 1906 the work in irrigation was under the direction of W. W. McLaughlin assisted

by S. M. Kershaw, while C. F. Brown had charge of the drainage work. Reports of the irrigation work were prepared by W. W. McLaughlin and E. R. Morgan, assisted by S. M. Kershaw, while C. E. Elliott and C. F. Brown prepared the report of drainage experiments.

The Utah Legislature of 1905, in providing additional work in irrigation and drainage under the direction of the Agricultural Experiment Station of the Agricultural College of Utah, passed the following bill:

"INVESTIGATION OF USE OF IRRIGATION WATER AND THE RECLAMATION OF ALKALI LANDS. An Act providing for the investigation of the proper use of irrigation water, and the reclamation of alkali lands.

Section 1. BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF UTAH: That the Agricultural Experiment Station of the Agricultural College be authorized and is hereby directed to conduct experiments and demonstrations on the proper use of irrigation water and the reclamation of alkali and water-logged lands in cooperation with the irrigation investigations of the Office of Experiment Stations of the United States Department of Agriculture.

Sec. 2. EXPERIMENTS IN IRRIGATION: RECLAMATION ALKALI LANDS: The experiments and demonstrations herein provided for shall include the investigation of water requirements of the crops ordinarily grown inUtah; the amount of water needed by the crops; the right time to apply the water; the best manner of its application; the influence of various methods of irrigation upon the quality of the crops produced; the irrigation requirements of the soils and subsoils of Utah; the relation of irrigation to the accumulation of alkali; the alkali and water-logged lands of Utah with reference to their reclamation; the possibility of reclaiming alkali lands by under-drainage and other means; together with such other investigations as have in view the economical use of irrigation water and the reclamation of alkali and water-logged lands.

Sec. 3. HOW EXECUTED: The work to be done under this act shall be planned and executed jointly by the Utah Experiment Station and the Office of Experiment Stations of the Department of Agriculture.

Sec. 4. REPORTS: The full reports of the results obtained shall be published annually, in editions of not less than 6,000 copies for free distribution among the farmers of the State.

Sec. 5. PROPOSITION U. S. DEPARTMENT OF AGRICULTURE ACCEPTED: The State of Utah accepts the proposition made by the Irrigation Investigations of the U. S. Department of Agriculture, namely, that the State of Uah appropriate $5,000.00 annually for the years 1905 and 1906 towards defraying the expenses of conducting the investigations outlined in Sec. 2 provided, the Irrigation and Drainage Investigations of the United States Department of Agriculture appropriate a like amount for this purpose.

Sec. 6. APPROPRIATION: That for the purpose of carrying out the provisions of this Act, $10,000 be appropriated from any moneys in the State Treasury not otherwise appropriated.

Sec. 7. This act shall take effect upon approval.

Approved this 21st day of February, 1905.

In accordance with this act there was planned in the spring of 1905, irrigation work at Logan for the purpose of studying the fundamental relation of irrigation water to crop production, with a view of determining the quantity of water necessary to secure the greatest yield, the time and method of its application and the effect upon the crop of different methods of cultivation. It is the most economic use, the greatest value of a given amount of water that is the ultimate object, rather than the maximum production value per unit of area, hence there must be determined for each crop the time when the application of additional water becomes unprofitable. It is not thought sufficient that the final recults merely, as to the quantity and quality of the crops be obtained, but also the effect of the application of water upon the crop throughout its growth. For this purpose certain plats were set aside and samples of the crops taken at short intervals during the growing season for chemical analysis. In this way the relative effect of large and small amounts of water, and of different methods and time of application would be determined and data secured on the question as to what stage in the growth of the crop the application of water is most effective.

The results of tests of previous years show that some of the water of a heavy irrigation may pass down beyond the reach

of the plant roots, and to study the action of the irrigation water in the soil, soil samples were taken in foot sections to a depth of eight to ten feet, and the moisture of these samples determined.

Realizing that differences in soil and climatic conditions modify to some extent, certain features in the results obtained, it was concluded that the only practical way to determine the influence of these varied conditions was to inaugurate in different parts of the State a series of experiments, having as a foundation the results obtained in Logan. For this purpose supplementary irrigation tests were carried on in Sevier, Sanpete. Tooele, Juab, Salt Lake, Weber, Millard, Box Elder and Morgan counties.

The work of 1905 emphazised the fact that the average practice throughout the State is a wasteful use of irrigation water, and it was thought advisable to obtain additional information upon the amount of water actually used by the farmers under their methods of irrigation. The State Engineer's office desired to obtain such information in relation to work on the Weber River System and therefore proposed cooperation with the Department of Agriculture and the Utah Experiment Station to study the usage of water in the vicinity of Ogden and Morgan.

In 1906 the State Engineer set aside a sum of money equal in amount to that set aside jointly by the Utah Experiment Station and the U. S. Department of Agriculture to carry on observations in this locality of the practical usage of water and experiments similar to those instituted in other parts of the State

Closely associated with the question of the amount of water to apply to crops is the method of its application. In some sections of the State under practically identical soil conditions, one farmer contends that flooding is the only method, while his neighbor insists that furrow irrigation is the method to be employed. The character of the soil and the nature of the crop should be considered in selecting the method, but to what extent they should influence in determining the method is not definitely known.

It is conceded that thorough and frequent cutilvation conserves soil moisture and results in a great saving of water applied by irrigation, but the information as to the best methods of cultivation and depth to which the soil should be cultivated is so meager as to warrant thorough investigation. As far as prac-

ticable this feature has been incorporated in the outside irrigation work.

Observations on the actual usage of water brought out very clearly the fact that the area of land that could be served by a given quantity of water depends to a considerable extent on the methods employed in the management of the canal, including the methods of distribution. During the present year a beginning has been made in a study of the various systems of canal operation in use throughout the State and as was to be expected, a few good practices with considerably more bad practices were found to exist.

Very recently a few experiments have been carried on in various Western States with a view of determining the value of "Winter Irrigation," and the Utah Experiment Station has undertaken this work in as far as funds will permit. There is but little question that using irrigation water on the non-irrigated lands during the months of October and November and the early spring months when there is a surplus, would greatly extend our cultivated area and prove at a very slight additional expense a more profitable and safer way of farming than the so-called "Dry Farming."

There are but meager data available on the irrigation of vegetables, fruit trees, vines, etc., and it is certainly time that some investigations were undertaken in Utah on the application of water to these products. In connection with the work of the Central Experiment Farm, under the direction of the Experiment Station, irrigation investigations are planned to include various horticultural crops.

It is the aim in all of this work to secure sufficient information to form a basis for the application of scientific principles in irrigated agriculture. It is thought advisable to not include too many problems of irrigation but to do the work so thoroughly that no question can arise as to the reliability of the results.

The U. S. Reclamation Service under its vast reclamation project is now endeavoring to obtain all the practical and scientific information that it is possible to obtain on the relation existing between water, soils and crops.

New canal and ditch organizations as well as the Reclamation Service must assign to the land some amount of water which is thought sufficient to produce profitable crops, and in the ab-

sence of accurate information there is but one chance in a thousand that the proper amount of water will be alloted. In case the water is too little, there is a loss to the farmer, and if too much water there will result a deterioration of the soil fertility, and a liabiltiy to water-logged and alkali land.

Within the borders of Utah there is under construction one large Government Reclamation project, namely, the Strawberry Valley project, and thousands of acres of land will soon be declaimed by private enterprises in Uinta, Millard and other counties. Most of these lands contain alkali and in some sections the soil is very difficult to handle. Too copious irrigation will bring the alkali to the surface and in low lying sections will result in alkali water-logged lands. Many of these lands will be settled with people unacquainted with irrigation practices and it is the duty of the State and Federal Governments to furnish such practical information as will enable the new settler to successfully cope with these problems. It requires numerous experiments and much time to determine the amount of water necessary to produce the most profitable crops. Such investigations involve considerable expense which the individual farmer is not prepared to meet, and even if he were able to take care of the financial part of the investigations, he has not the time at his disposal to undertake systematic investigations. Further, if these investigations were undertaken and successfully completed by an individual in any section, they probably would not be made public and certainly would not be applicable to sections differing in soil and climate. The judicious use of irrigation water will greatly enlarge the present irrigated area of the State, resulting in increased wealth, and would also prevent to a large extent, the increase of our now vast area of water-logged and alkali lands.

The drainage of western lands invclves practices entirely different from those of a humid section, and as yet but little information is obtainable on the principles underlying the reclamation of western lands by drainage. Each State and each section within the State has its own peculiar conditions necessitating drainage plans differing very materially from those adapted to another section. These investigations are rather more hazardous than irrigation work in that if the drainage is not successful no revenue is forthcoming, while even with a poor system of irrigation, some financial return is realized. In all of our older irrigated sections

there is a need for drainage and particularly for the reclamation of those lands which, in early days, produced most abundantly, but today are practically unproductive.

By proper methods of irrigation and drainage it has been estimated that Utah's agricultural area could be increased with the present water supply at least one-half. This would mean considerable wealth to the State and the increased revenue would compensate many times for the money required to conduct the necessary experiments.

In view of the above facts, and further, that the Office of Experiment Stations of the U. S. Department of Agriculture is willing to continue its present cooperative relations, thus providing for the expenditure of two dollars within the State for each one dollar expended by the State, it would seem that Utah would be making a wise investment to continue the Irrigation and Drainage Investigations as carried on during the past six years under the direction of the Utah Experiment Station.

IRRIGATION INVESTIGATIONS in 1905

By E. R. Morgan

INVESTIGATIONS IN SEVIER COUNTY.

The investigations were made at Richfield in cooperation with Mr. P. C. Poulson, on what is known as the old Chris Poulson farm. The experimental tract is situated about 2½ miles south of Richfield.

Soil.

There are three perhaps principal types of soil in this locality, viz., an alluvial soil containing some alkali, a mixture of sand and clay and a compact clay. A considerable amount of clay area needs drainage, but the farm under observation lies near the line between the second and third types of soil and is typical of a large area of land.

Crops and Climate.

The principal crops grown in this vicinity are wheat, oats, barley, alfalfa and alfalfa seed. Some of the hardier fruits are produced in limited quantities. Several efforts have been made to grow sugar beets, but thus far they have resulted in a partial failure. However, this probably is due to beet blight, worms, white flies and a lack of experience upon the part of the farmer in sugar beet culture rather than any defect of the soil or climatic condition. The precipitation in this locality is light.

The Plats.

There were approximately 7½ acres of land seeded to alfalfa included in the experimental tract, 4½ acres of which were divided into six plats. These produced alfalfa hay. The remainer of the tract was divided into six plats which produced alfalfa seed.

The ditch which carried the water to the field was provided with a headgate and a measuring weir. The field was divided into two rows of plats, each of which was provided with a supply ditch. Between the bottom of the first row of plats and the supply ditch for the second row, also along the bottom of the second row of plats, were ditches provided for the purpose of carrying the waste water from each plat to a measuring weir at the bottom of the field.

Alfalfa Hay.

The following is a plan of the proposed irrigations for the alfalfa hay plats:

Plat No. 1.—Check plat—To be irrigated as farmer chooses.

Plat No. 2—To be irrigated just before cutting first and second crops.

Plat No. 3.—Same as plat No. 2, but to receive twice as much water at each irrigation.

Plat No. 4.—Same as plat No. 2 but to receive one-half as much water at each irrigation.

Plat No. 5.—To be irrigated two weeks and one week before cutting first and second crops respectively.

Plat No. 6.—To be irrigated just before cutting first, second and third crops respectively.

Note: All plats to be irrigated by the furrow method.

Table showing number of plats, date of irrigations, amounts of water applied over entire area of plats in inches, and the amounts retained in inches, dates of harvesting crops, the yield in tons per acre and in tons per acre foot of water applied.

RICHFIELD PLATS—ALFALFA HAY.
Irrigation Test, 1905.

Plat No.	Date of Irrigation	Inches applied	Inches wasted	Inches retained	Date hauled	Yield in tons per acre	Tons of hay per acre ft. of water
1	May 26..	4.94	0.35	4.59	June 29...		
	June 11..	2.30	0.11	2.19	Aug. 28...		
	July 6...	5.35	0.20	5.15	Oct. 14...		
	Aug. 10..	5.08	0.09	4.99	Oct. 14...		
	Sept. 5..	5.08	0.22	4.86			
		22.75	0.97	21.78		8.23	4.54
2	June 21..	4.87	0.38	4.49	June 29..		
	Aug. 16..	4.74	0.22	4.52	Aug. 24...		
		9.61	0.60	9.01		3.99	5.32
3	June 19..	10.84	0.90	9.94	July 1....		
	Aug. 15..	7.17	0.46	6.71	Aug. 24...		
		18.01	1.36	16.65		5.65	4.07
4	June 20..	4.56	0.07	4.49	June 30...		
	Aug. 16..	2.35		2.35	Aug. 24...		
		6.91	0.07	6.84		4.18	7.73
5	June 11..	4.51	none	4.51	July 1...		
	June 22..	3.08	"	3.08	Aug. 29...		
	Aug. 3..	2.68	"	2.68	Oct. 14...		
	Aug. 15..	2.82	"	2.82			
	Sept. 20..	2.68	"	2.68			
		15.77		15.77		6.21	4.73
6	June 21..	5.35	0.23	5.12	June 30...		
	Aug. 16..	4.90	0.19	4.71	Aug. 26...		
		10.25	0.42	9.83		4.44	5.42

Discussion.

In making comparisons of the different quantities of water applied and the yields produced, it must be remembered that the results obtained were from one season's work and that further investigations may modify them. However, it can reasonably be expected that the results obtained show in a general way what the practice should be for this particular locality during a year of normal precipitation.

A comparison of the amounts of water applied to each plat with its yield indicates that production **tends to vary as the amount of water applied** within the limits of the amounts used used in this test. It will be observed, however, that plat No. 5 produced 0.56 tons more per acre with 15.77 inches of water applied in five irrigations, than plat No. 3 did with 16.55 inches applied in five irrigations.

Plats Nos. 2 and 4 each received two irrigations. The former retained 2.17 inches of water more than the latter, but its yield was not as great as that of plat No. 4, although the difference is small. It will be seen that the greatest yields per acre were produced on plats Nos. 1 and 5, which received five reasonably heavy irrigations. The maximum pield per acre foot of water applied was 7.73 tons, which was produced on Plat No. 4.

Alfalfa Seed.

The test with alfalfa seed was made on plats adjoining those on which hay was produced. Provision was made for a test of the value of clipping the crops as well as for irrigation. In some localities difficulty has been experienced in producing good seed from first crop fodder on account of the growth being so dense that but few blossoms appear and the fact that those which appear are so poorly fertilized and imperfectly matured. In other cases where one crop of hay yas produced and an attempt made to get a crop of seed, it frequently happened that the early fall frost would prevent the seed from thoroughly ripening. These conditions naturally suggested that it would be well if the seed crop could be started some time between early spring and the time when the first crop of hay is ready to harvest. To accomplish this result the seed field is sometimes pastured for a time, but as a substitute for that practice, clipping was resorted to in

this experiment. The seed plats were numbered from 7 to 12, inclusive. Plats Nos 7, 8 and 9 were clipped down to within 4 or 5 inches of the surface of the ground when the crop had a height of about 8 inches.

The amounts of water which were applied each time were determined by the farmer. The following schedule shows what treatment each of the plats received.

Plat No. 7.—Not to be irrigated.
Plat No. 8.—To be irrigated when in blossom.
Plat No. 9.—To be irrigated May 7 and when forming seed.
Plat No. 10.—Not to be irrigated.
Plat No. 11.—To be irrigated same time as plat No. 8.
Plat No. 12.—To be irrigated same time as plat No. 9.

Note.—Plats to be irrigated by the furrow method.

The farmer was given the opportunity to choose the plat which in his judgment would yield best. He selected Plat No. 11 which was used as a standard with which to make comparisons and also to determine the deficiency or surplusage of yield on the other plats, so that a settlement between him and the State and Federal Departments could be made.

The effect of clipping was plainly noticeable as late as July 1st, when the crops on plats Nos. 7, 8 and 9 were about 18 inches high and just beginning to blossom, while those on plats Nos. 10, 11 and 12 were about 24 inches high and in full bloom. When the plats were in full bloom the flowers were infested with a light colored insect. These are believed by some to be very injurious to a seed crop, while others were inclined to the view that they were necessary to the proper ferilization of the flowers. The latter view may not be entirely correct but it is reasonably certain that the insect does not injure the seed crop, as the blossoms on all of the plats were infested to the same extent as near as could be estimated, and the results obtained were materially different.

The following table shows the numbers of the various plats, the dates when irrigated, the amounts of water applied, wasted and retained in inches, and the yields in pounds per acre.

RICHFIELD PLATS.—ALFALFA SEED.
Irrigation Test, 1905.

Plat No.	Date of Irrigation	Water applied Inches	Wasted Inches	Water retained Inches	Yield in pounds per acre	Notes
7		no irrigation			209.5	clipped
8	July 20...	7.93	0.23	7.70	846.6	clipped
9	May 25...	5.53	0.28	5.25		clipped
	Aug. 3...	8.39	0.02	8.37	293.9	clipped
		13.92	0.30	13.62		
10		no irrigation			146.0	not clipped
11	July 6....	7.63	0.20	7.43	278.2	not clipped
12	May 25....	5.12	0.60	4.52		not clipped
	July 20...	5.14	0.17	4.97		
		10.26	0.77	9.49	153.8	not clipped

An inspection of the table seems to indicate that to produce a good crop of alfalfa seed, some irrigation is necessary from the fact that plats Nos. 7 and 10, which received no water, yielded poorly. Plats Nos. 9 and 12 were irrigated May 25 and again later in the season. The results were that too much fodder was produced which lodged, and as a consequence the seed crop did not mature well. This statement seems to be substantiated in that the yield on plat No. 9 which was clipped as 293.9 pounds per acre as compared with 153.8 pounds per acre on plat No. 12, which was not clipped. The effect of clipping was to reduce the amount of fodder which allowed the seed to mature later. The yield in plats No. 8 and 11 were best. The plats were irrigated when the crops were in bloom. The former yielded at the rate of 846.6 pounds per acre, while the latter yielded only 278.2 pounds per acre. As the amounts of water applied to these plants were about the same and the crop was at the same stage when they were irrigated, the yield seemed to indicate that clipping is a pertinent factor in alfalfa seed production.

The following table shows the number of the various plats, the dates when they were irrigated, the amount of water applied to each plat, the yields, including and not including the straw and chaff on each plat, the yield in bushels per acre, and per acre-foot of water applied:

Plat No	Date of irrigation	Water applied Inches	Waste Inches	Yield of straw and chaff Pounds	Yield of grain Pounds	Yield per acre Bushels	Yield per acre foot including waste water Bushels
1	June 9.	7.70	lost				
	June 24.	2.54	0.28				
	July 8.	2.64	0.39				
		12.88		2,797	2,400	78.3	73.0
2	June 9.	8.52	lost				
	June 25.	6.89	1.85				
	July 9.	5.65	1.38				
		21.06		2,880	2,640	82.6	47.1
3	June 9.	3.76	lost				
	June 25.	3.29	0.34				
	July 9.	1.82	0.15				
		8.87		1,575	1,720	59.4	80.3
4	June 9.	7.02	lost				
	June 24.	3.79	0.35				
	July 9.	3.31	0.41				
		14.12		3,115	3,245	89.6	76.1
5	July 9.	6.65	0.15	1,962	1,353	31.1	56.0
6	June 9.	7.54	lost				
	June 24.	8.58	1.69				
	July 9.	2.95	0.18				
		19.07		3,810	3,280	85.1	53.6

A study of the above table shows that the maximum yield per acre was obtained from plat No. 4, which received 14.12 inches of water. Plat No. 1 received 12.88 inches of water and yielded 78.3 bushels per acre. Plat No. 2 received enough water to cover it to a depth of 21.06 inches and yielded 82.6 bushels per acre. Assuming that the yield on Plat No. 4 would have been increased had more water been used, the above comparisons show that for the greatest yield per acre the best amount of water to apply would be somewhere between 14.12 and 21.06 inches. Plat No. 6 was flooded and was intended to compare with plat No. 1 as both should have received the same quantity of water. But owing to the difference in the methods and the difficulties met by the flooding method, plat No. 6 received nearly as much as No. 2. A comparison of the results obtained from Nos. 2 and 6 shows that 21 inches is too much water to use or that a less amount applied by the flooding method is better.

The treatment given Plat No. 5 was intended to show the effect of a single application of water at the time when the crop was filling. The results were poor, but conditions under which the test was made were very unfavorable. Instead of drilling in two bushels per acre, one-half this amount would have shown better results; for the reason that the thick stands which came up sapped the soil of its moisture and nutriment before the crop was ready to fill and as a result less than 20 per cent of the crop headed and filled. At this stage it received its allotment of water, which had little effect on the crop harvested. This was evidenced by the rank growth after the crop proper had been produced. The results would have been much better had a lesser amount of grain been sown and the water applied at a time when its use seemed imperative to the further development of the crop.

A further inspection of the table shows that plat No. 3 received 8.87 inches of water and yielded 59.4 bushels per acre and plat No. 4 received 14.12 inches and yielded 89.6 bushels per acre. But the former shows a yield of 80.3 bushels per acre-foot of water applied as compared with 76.1 bushels for the same quantity of water used on the latter.

The subject of maximum yield per acre, versus maximum yield per acre-foot of water used has occupied and is now occupying the attention of scientific irrigators in the arid States. Foremost among the reports giving data on his subject are bulle-

tins Nos. 80 and 86 of this Station. Proceeding on the basis that production without profit is not desirable under normal conditions, more comparisons and some estimates will be given with the veiw of enabling the farmer to intelligently solve problems of this kind which present themselves to him.

Profits in farming as in other industries necessarily involve the cost of crop production. The cost per acre of planting, irrigating and harvesting a crop of grain produced as were those on Plats Nos. 3 and 4, would be approximately the same. An estimate of these costs for Utah in the year 1905 is as follows:

Plowing and harrowing	$ 2.00
Drilling	0.30
Seed	1.00
Irrigating (3 times)	1.20
Cutting, shocking	1.50
Hauling	0.75
Threshing	3.85
Total	$10.60

The average price realized by the farmer for oats grown during the season of 1905 was not more than $1.50 per hundred pounds. Therefore the cost of producing one acre of oats would be 22.1 bushels of the crop. The yield per acre on plat No. 4 was 89.6 bushels. Deducting the cost of production, namely 22.1 bushels, leaves a net yield of 67.5 bushels per acre. Plat No. 3 yielded 59.4 bushels per acre or a net yield of 37.3 bushels per acre. But plat No. 4 received 1.59 times as much water as plat No. 3 and hence the amount of water used on one acre of plat No. 4, would have covered 1.59 acres of land to a depth equal to that applied on plat No. 3. In such cases the gross yield resulting from the use of the same quantity of water as applied on one acre of plat No. 4 would be 1.59 times 59.4, the gross yield per acre on plat No. 3, which is 94.4 bushels. According to the estimates already made, the cost of producing this yield would be 33.7 bushels, which would leave a net yield of 59.3 bushels from an area of 1.59 acres, as compared with 67.5 from one acre of plat No. 4, the same quantity of water being applied in each case. In addition to the above results it cannot be disputed that the .59 acre would be better for future use had it been summer fallowed instead of being made productive.

The above statement should not be construed as being an argument in favor of heavier irrigation. The detrimental results of this practice are so numerous in irrigated areas as to scarcely need mention.

The object sought above is to point out that in all irrigated districts there is a limit to the area which can be most economically irrigated with a given supply of water. It is also probable that the above results show that with such conditions as surrounded this test water applied to a deph of 9 inches is not the most economical use of a given volume. The best use of water as shown by the results of this experiment would be such as would cover the area to a depth equal to or exceeding 14.12 inches and less than 21.06 inches so long as the cost of production and the price of oats remain constant. But if the cost of production can be lowered and the price of the crop maintained, the gain will help offset the disadvantages of the method employed on plat No. 3. This is not probable unless accomplished by improved machinery, for the reason that as the purchasing value of a dollar in service increases, the price of the crop sold to obtain the dollar decreases.

The table shows that the yield of straw was approximately proportional to the yield of grain, except with plats Nos. 5 and 6. Plat No. 5 yielded 1,962 pounds of straw and 31.1 bushels of oats per acre, while plat No. 3 yielded only 1,575 pounds of straw and 50.4 bushels per acre. This is accounted for by the fact that the late irrigation of plat No. 5 produced a second growth which was partly harvested with that which ripened first. Plat No. 6 produced 3,810 pounds of straw and 85.1 bushels per acre as against a lesser yield of straw and a greater yield per acre of oats on plat No. 4. This is accounted for by the fact that the farmer received nearly five inches more water during the season that did the latter.

INVESTIGATIONS IN TOOELE COUNTY.

The farm selected is situated one-half mile west of the main part of the town of Tooele and is owned by Willard Atkin, a progressive and successful farmer. It is typical of the best class of land in Tooele County. The soil is a rich clay loam. The experiments were made under favorable conditions and the results are such as to justify the claim of highly intensified grain farming.

At the beginning of the season of 1904, the experimental tract received 25 loads (3,000 pounds) of barnyard manure. In the autumn of 1904 the land was plowed and in the spring of 1905 it was seeded with three bushels of oats per acre. The tract was furrowed at the time of planting so as to aid in irrigating, as this was considered the best method of applying the water. After arrangements were completed with Mr. Atkin, the tract was divided into six equal plats. The same schedule of irrigations was followed in this test as in that in Juab county on Grace Brothers' farm. It was thought that considerable damage was done as a result of dragging down the furrows on Plat No. 6 so that it could be flooded, but the crop soon appeared in good condition. The following table shows the numbers of the plats, dates when irrigated, amounts of water applied, wasted and retained, the total yield of straw and chaff and grain and the yield in bushels per acre and per acre-foot of water retained:

Plat No.	Date	Water applied Inches	Waste Inches	Water retained Inches	Yield of straw and chaff Pounds	Yield of grain Pounds	Yield per acre Bushels	Yield per acre-foot including waste water Bushels
1	June 5..	5.08	0.31	4.77				
	June 19..	6.07	2.27	3.80				
	July 2..	4.07	0.82	3.25				
	July 15..	2.93	0.18	2.75				
		18.15	3.58	14.57	2,132	1,938	94.5	62.5
2	June 5-6.	10.15	0.32	9.83				
	" 19-20	10.07	2.34	7.73				
	July 2...	8.14	1.45	6.69				
	" 15-16	5.86	0.72	5.14				
		34.22	4.83	29.39	2,043	1,987	96.9	34.0
3	June 5..	4.60	0.29	4.31				
	June 19..	2.58	0.50	2.08				
	July 16..	1.46	0.03	1.43				
	July 2..	1.93	0.06	1.87				
		10.57	0.88	9.69	1,550	1,270	59.0	67.0
4	June 6..	2.47	0.28	2.19				
	June 19..	2.71	0.91	1.80				
	July 2..	3.86	0.49	3.37				
	July 16..	2.93	0.12	2.81				
		11.97	1.80	10.17	1,772	1,488	72.6	72.6
5	June 20..	10.07	1.94	8.13				
	July 16..	5.86	0.20	5.66				
		15.93	2.14	13.79	1,585	1,285	62.7	47.2
6	June 6..	5.82	0.10	5.72				
	June 19..	5.03	0.60	4.43				
	July 3..	3.86	0.30	3.56				
	July 16..	2.93	0.07	2.86				
		17.64	1.07	16.57	2,271	1,919	93.6	63.8

An inspection of the table shows that plat No. 1, which was furrowed, gave a slightly higher yield per acre and a slightly lower yield per acre-foot of water retained than plat No. 6, which was flooded. The latter plat received two inches more water during the season than the former. It will also be noticed that plat No. 6 produced more straw than any other plat. Plat No. 2 retained a little more than twice as much water as plat No. 1. It shows a little higher yield per acre than No. 1, but only about 50 per cent of its yield per acre-foot of water retained. Plats Nos. 3 and 5 show comparatively low yields, both per acre and acre-foot of water used. The former plat did not receive enough water. This fact was apparent, for the reason that the good grain was produced adjacent to the supply ditch, while the crop at the lower end of the field partially failed. The crop on Plat No. 5 suffered before it was first irrigated, after which a second growth came. As a consequent the oats ripened unevenly. It will be noticed that plat No. 4 produced the highest yield per acre of water used.

The farmer has decided that the use of water as applied on plat No. 4 is more productive and profitable than as applied on plat No. 1, notwithstanding the fact that the latter produced 94½ bushels as compared with 72.6 bushels on plat No. 4.

The cost of producing one acre of oats at Tooele would not be materially different from that at Nephi, except in the matter of fertilizing. For large areas it would be impossible to obtain enough of the fertilizer named to treat the land in the manner described and so this item may be neglected by the extensive farmer.

Subtracting the cost of producing one acre of oats, as was formerly estimated, namely, 22.1 bushels of oats, the net yield of plat No. 1, would be 72.4 bushels per acre. In such a case the gross yield of 1.51 acre-feet of water would be 1.51 times the gross yield per acre on plat No. 4, or 109.63 bushels. The cost in bushels of oats to produce a crop on the area which would have to be used to cover it to a depth equal to that received by plat No. 4, would be 1.51 times 22.1 bushels per acre or 33.37 bushels. The net yield then for 1.51 acre-feet of water would be 76.3 bushels of oats when the land is irrigated as was plat No. 4, as against 72.4 bushels for the same quantity of water when a smaller area is treated as was plat No. 1. Besides a gain of 3.9 bushels of oats per 1.51

acre-feet of water used, there would be about 1⅓ times the employment furnished at remunerative wages, as would be if the water were used as it was on plat No. 1.

These results are not necessarily final and should be used by the farmer for what they actually show. The investigations have tended to show to the farmer with a small area, that the manner of irrigating plat No. 1 is far better than that of plat No. 2. That to a farmer with a greater area and a limited water supply it would be better to irrigate his land as was plat No. 4 rather than treat it as was plat No. 1. It may be advisable to increase the amount given to plat No. 4 in order to obtain a maximum yield from a given quantity of water. The matter should be the subject for further investigation.

BOX ELDER COUNTY INVESTIGATIONS.

Sugar beets, alfalfa hay, wheat, oats and fruit are the staple crops of Box Elder County. For the most part fruit is produced toward the southeastern part, while the other crops are produced in the valley through which the Bear and Malad rivers flow. The latter locality is the one to which attention is invited. The general course of the rivers named is southward, and so the slope of the land adjacent to them is eastward and southward or westward and southward, according as it lies on their right or left banks. Generally speaking the slope is slight and the subsoil is of an impervious nature and consequently the drainage conditions are poor. The soil is deep and composed of rich clay loam. At various places in the valley alkali is beginning to appear, but only a few locations are injured by it.

The experimental tract is situated about two miles north of the town of Garland on a farm owned by Mr. George Austin, agricultural superintendent of the Utah Sugar Company. The soil with its drainage conditions is typical of a very large area in the valley. At the time arrangements were made with Mr. Austin, the crop was planted and the soil was in excellent condition for growing sugar beets. There were a few indications of alkali though not in sufficient quantities to interfere with the production of a good corp. The farm had been troubled some with seepage water, but an open ditch between it and the source of supply relieved conditions materially. After the tract was selected, it was divided into eight plats, for which a schedule of irriga-

tion was prepared similar to that shown in the discussion of Utah County investigations. Owing to some mistake in calculating, the amounts of water applied to several plats are at variance with the schedule. However, the mistakes did not affect the quantities of water applied to the various plats and so the data collected are valuable in that they show the results obtained from the application of different quantities of water.

The following table shows the numbers of the plats, the dates when irrigated, the amounts of water applied, the yield in tons per acre, and the yield in tons per acre-foot of water used:

Plat No.	When Irrigated	Water applied Inches	Yield per acre Tons	Yield per acre-foot of water used Tons
1	July 12........	3.25		
	July 26........	2.03		
	Aug. 18........	2.03		
		7.31	24,203	39.73
2	July 12........	9.25		
	July 26........	3.06		
	Aug. 18........	3.06		
		15.37	20,636	16.11
3	July 13........	4.84		
	July 26........	1.91		
	Aug. 18........	1.91		
		8.66	19,952	27.64
4	July 13........	2.84		
	July 26........	1.44		
	Aug. 18........	1.54		
		5.82	18,544	38.23
5	July 13........	2.84		
	July 26........	1.91		
	Aug. 18........	1.91		
		6.66	18,423	33.19

Plat No.	When Irrigated	Water applied Inches	Yield per acre Tons	Yield per acre-foot of water used Tons
6	July 13.........	6.67	Furrowed	
	July 26.........	2.62		
	Aug. 18........	2.75		
		12.05	20,656	20.57
7	July 13.........	9.10		
	July 26.........	2.30		
	Aug. 18........	1.84		
		13.24	20,950	18.99
8	July 13.........	6.92	Night Irrigation	
	July 26.........	2.55		
	Aug. 18........	2.55		
		12.02	21,325	21.30

An inspection of the table shows that plat No. 1 which was covered to a depth of 7.31 inches during the season, produced a greater yield per acre and per acre-foot of water used than any of the other plats. Plat No. 2 was covered more than twice as deep as Plat No. 1 and the yield per acre-foot of water used was reduced to about 2-5 of what was on plat No. 1, and the yield per acre and per acre-foot of water used was materially decreased. Plats Nos. 4 and 5 each received less water than plat No. 1 and the yields were less according to both standards of measure. The results obtained on Plat No. 7 were not materially different from those obtained on Plat No. 2 with an increase of about two inches in depth of water, except that plat No. 7 shows an increase in yield per acre-foot of water used. Plats Nos. 6 and 8, received practically the same quantity of water during the season and it was applied on the same dates in approximately the same amount each irrigation. The former was irrigated during the day and the latter at night. The results show a slight increase

in yield per acre and per acre-foot of water applied for the plat that was irrigated at night.

It is thought that when cold water is applied to a crop during a hot day, the sudden change in temperature may tend to hold back the growth of the plants and prevent a full development ultimately. The night irrigations were not commenced until about 10 p. m. in order that the soil might have a chance to partially cool before the water was applied.

While the above tests were made under conditions which are typical of a larger area of the best land in the valley, it may be that underground water materially reduced the necessity for the artificial application of water. In the use of the above data the conditions under which the tests were made should be considered.

UTAH COUNTY INVESTIGATIONS.

The experimental tract is situated about 3 miles north of Provo in the river bottom, on the farm owned by A. L. Tanner, with whom we cooperated. The nature of the soil and the water requirements here are very much different from those at Garland, but are typical of a large area of land used for beet culture. The soil is sandy, gravelly. loam underlaid with coarse gravel which insures perfect drainage. The experimental tract which consisted of about 2 2-3 acres, was divided into seven plats and sown to sugar beets. The water supply consisted of return seepage water from the adjacent benches. The volume was always in excess of the needs and could be used when desired. The measuring device and headgate were so located that the head on the weir remained practically constant after having been once adjusted.

The following schedule of irrigations for the various plats was arranged:

Plat No. 1.—Check plat.—To be irrigated as farmer chooses.

Plat No. 2.—To be irrigated on same days as Plat 1, with twice as much water applied.

Plat No. 3.—To be irrigated same as plat 2, using one-half as much water as on plat 1.

Plat No. 4.—To be irrigated about June 15th and about August 4th.

Plat No. 5.—To be irrigated every three weeks, beginning about June 15th.

Plat No. 6.—To be irrigated same days as plat 1, but the amount of water to be increased two fold each irrigation.

Plat No. 7.—To be irrigated same day as plat 1, but by flooding.

The following table shows the number of the various plats, the dates when irrigated, the amount of water applied, yield in tons per acre, and yield in tons per acre-foot of water applied:

Plat No.	Date of Irrigation	Amount applied Inches	Yield per acre Tons	Yield per acre-foot of water applied Tons
1	June 22	2.38		
	July 7	3.53		
	July 26	5.51		
	Aug. 10	8.23		
	Aug. 22	12.57		
	Sept. 6	14.46		
		46.68	22,711	5.84
2	June 22	4.59		
	July 7	6.96		
	July 26-27	10.05		
	Aug. 10	13.97		
	Aug. 23	15.72		
	Sept. 6-7-8	20.36		
		71.65	18,912	3.17
3	June 22	1.17		
	July 8	1.72		
	July 28	2.74		
	Aug. 10	4.15		
	Aug. 24	6.15		
	Sept. 7	7.16		
		23.09	15,668	8.14
4	June 22	2.38		
	Aug. 4	6.96		
	Aug. 23	12.50		
		21.84	14,892	8.18

Plat No.	Date of Irrigation	Amount applied Inches	Yield per acre Tons	Yield per acre-foot of water applied Tons
5	June 23.........	2.34		
	July 15........	7.76		
	Aug. 2........	9.57		
	Aug. 21-22.....	11.23		
	Sept. 12........	16.69		
		47.59	18,087	4.56
6	June 24........	1.23		
	July 15.........	2.41		
	Aug. 2........	5.65		
	Aug. 21-22.....	16.55		
	Sept. 12........	14.01		
		39.85	14,211	4.27
7	June 24........	2.35		
	July 8........	3.46		
	July 28.........	5.50		
	Aug. 10-11.....	8.28		
	Aug. 24........	9.46		
	Sept. 7-8.......	6.66		
		35.71	20,135	6.76

Plat No. 1 received water to a depth of 46.68 inches during the season in six irrigations. It yielded 22.71 tons of beets per acre and 5.84 tons per acre-foot of water applied. These results are better from either point of view than those of any other plat. The use of 71.65 inches of water on plat No. 2 in the same number of irrigations shows a decrease in yield per acre, as well as a decrease in yield per acre-foot of water used. It will be observed that this plat was irrigated on two succeeding days in July and on three succeeding days in September. This method of applying a large quantity of water was necessary for the reason that the soil would not otherwise retain twice as much as that applied

to plat No. 1, as was intended by the above schedule. Even with the method employed, the irrigation did not accomplish the aims of the schedule on the above named dates. Plat No. 3 received about one-half as much water as plat No. 1, with the same number of irrigations. The yield per acre is less than that of plat No. 1, while the yield per acre-foot of water used is 8.14 tons as against 5.84 tons. The results in the way of yield on plat No. 4, as well as other effects which will be discussed later, warrant the statement that three applications of water amounting to less than two feet in depht on a given area is not an economical use of the water. The results on plat No. 5 show the effects of applying lim-quantities of water in the early part of the year with a gradual increase toward the time of the maturity of the crop, the total quantity received during the entire season being practically the same number of times as plat No. 5 and on practically the same dates, but received a lesser quantity of water. The schedule of irrigation was made with the intention of applying the same quantity of water to plat No. 7 as to plat No. 1, the former to be flooded. Owing to a mistake in calculation, the value of this comparison was destroyed.

Considerable discussion and speculation has been engaged in among beet growers regarding the effect of irrigation on the shape and size of the beets and consequently the yield and probable sugar contents. It has been urged that the beet should be allowed to feel the necessity of moisture, but not allowed to suffer before the crop is irrigated for the reason that it would extend the tap root deeper into the soil and as a result would more likely become a well-shape, good sized beet. For about the same reason it has been said that light irrigations at the beginning of the season are better as the tendency of the beet to penetrate is not overcome except where an abundance of water is furnished toward the beginning of the season. Reasoning in the same way the furrow method is urged as against the flooding method. Observations were made at the time the crops were dug with a view to ascertaining the facts as shown by one test. Most of the beets of plat No. 1 were well-shaped and good sized. However, they were shorter than they should have been. They were pretty well covered with root hairs, which caused a large percentage of dirt to adhere to them. Some few beets were very short, but the percentage of small beets was low.

Plat No. 2 produced the shortest beets of any of the plats. Most of them were very dirty and a considerable number were inclined to be turnip shaped. The percentage of small beets was low. The beets produced on plat No. 3 were fairly well shaped, but the percentage of small beets was higher than on plats 1 and 2. Plat No. 4 produced clean well-shaped, good sized beets. The beets grown on plat No. 5 were well-shaped. They were very dirty and the percentage of small beets was medium. The tap roots penetrated deeply into the soil which accounts in part for their shape.

Plat No. 6 produced the smallest and poorest shaped beets of any grown on the experimental tract. It was also observed that the growth of tops was exceptionally heavy. Some of the beets produced on No. 7 were very large and the percentage of small beets rather high. Generally speaking, the beets were poorly shaped and a considerable number were forked. It is thought that the water being applied at the surface (flooding method) was largely responsible for these results.

From the above facts and the data given in the table, it would seem that the contention that the plants should be allowed or forced to penetrate well into the soil for moisture before irrigation is resorted to may be well grounded and likewise that the furrow method is probably better than the flooding method.

Sugar-beet blight during the season of 1905 hampered the production of sugar beets. It is not proposed to discuss the nature of blight any more than to say that it seems to surround the beets with a moldy growth, resulting in a shrivelling of the leaves and a dwarfing or killing of the beet. Some observations were made relative to the effect of blight on the various plats as compared with the amounts of water received and the methods of applying it.

Plats Nos. 1, 2 and 5 received most water and were affected least with the blight, but plats 2, 4 and 7 received less water than plat No. 6 and were damaged less. From these facts it would seem that plenty of water tends to prevent blight, but that the damage done by it is not proportional to the amounts of water applied.

INVESTIGATIONS IN MILLARD COUNTY.

Before emptying its unappropriated water into the remnant of Sevier Lake, the Sevier River flows through a very level and broad valley, which is broken only by lava beds and sand dunes. In this valley and adjacent to the above-named river, the tests were conducted. The gradient of the river and the slope of the country toward it is very small and consequently the valley has practically no drainage. Several years ago after a succession of seasons during which the water supply was abundant, the soil became water-logged. The ground water was often found at a depth of one foot and less from the surface. This condition was followed by a drouth of several years' duration, since which the soil has been suitable for crop production. Generally speaking, it is a heavy clay of considerable depth, underlaid with an impervious shale or compacted clay. Alfalfa is the principal crop, but wheat will be a staple crop if the water supply can be properly controlled. Apples and plums are raised in limited quantities.

The experiments were made on the farm of A. A. Hinkley, which is situated about one-half mile north of the town of Hinckley. The soil is a heavy clay about thiry inches deep underlaid with a subsoil of tenacious blue clay. The land slopes very gently to the south and owing to this fact, the check method of irrigation was employed. The supplying ditch was provided with a measuring weir, but owing to the method of irrigating the plats, no water was permitted to waste. The plats were seeded to wheat and as is usually the case, were irrigated to produce germination. The first irrigation of the plats was begun by Mr. Brown and continued by the farmer. Owing to an overisght on the part of the latter, the second watering turn was allowed to pass. As a result the crop was badly damaged. By the time the third irrigation turn came, the weeds were so abundant in all but plats Nos. 1 and 2 as to render the results practically worthless. The amount of water applied to these plats was measured. The scheduel of irrigations is similar to that for Tooele and Nephi.

The following table shows the amount of water applied to plats Nos. 1 and 2, the dates when irrigated, the yields per acre, and the yield per acre-foot of water applied.

Plat No.	Date	Water Applied Inches	Yield per Acre Bushels	Yield per Acre-Foot of Water Applied Bushels
1	June 15 July 17	8.89 8.89 17.78	25.0	16.9
2	June 15 July 17	16.76 15.14 31.90	17.4	6.55

Note: Plats were dyked, no runoff.

INVESTIGATIONS IN SALT LAKE COUNTY.

These investigations were conducted at Holiday, which lies at the base of the Wasatch range of mountains, about 10 miles in a southeasterly direction from Salt Lake City. The experimental tract is owned by A. E. Stout. The crop used in the test was potatoes of the Early Ohio variey. Black loam mixed wih light clay constitues the soil which is underlaid with clay. Notwithstanding the impervious nature of the subsoil, the ground water is deep and the drainage is good. The field on which the experimental plats were located produced oats during the season of 1904. It was plowed that autumn and received a heavy coat of fertilizer the following spring preparatory to planting the crop experimented with. The climate of this locality is such as to favor the production of tender fruits and vegetables, which are the principal crops grown.

The following schelude of irrigations shows the plan of the work:

There were six plats in the experiment and the irrigations were planned as follows:

Plat 1.—Check plat, to be irrigated as farmer chooses.

Plat 2.—To be irrigated at the same time as plat No. 1 but to receive one and one-fourth times as much water at each irrigation.

Plat 3.—To be irrigated same as plat 2 except to receive six-tenths as much water as plat 1.

Plat 4.—To be irrigated every ten days using at each irrigation one-half as much water as plat No. 1.

Plat 5.—To be irrigated every twenty days, using at each irrigation same amount of water as in plat No. 1.

Plat 6.—To be irrigated same as plat No. 1, but by flooding.

The following tables show the numbers of the plats, the dates when irrigated, the amount of water applied, wasted and retained, the yield in bushels per acre, the yield in bushels per acre-foot of water applied and the percentage of unmarketable potatoes.

Plat No.	Date	Water applied Inches	Wasted Inches	Retained Inches	Yield per acre Bushels	Yield per acre-foot of water applied Bushels	Percentage of small Potatoes Per Cent.
1	July 10..	2.26	0.21	2.05			
	July 15.	1.05	0.11	0.94			
	July 26.	1.22	0.17	1.05			
	Aug. 4.	1.57	0.16	1.41			
	Aug. 14	1.99	0.60	1.39			
	Aug. 24.	2.99	0.52	2.47			
	Sept. 3	2.99	0.52	2.47			
		14.07	2.29	11.78	257.9	220.0	4.7
2	July 10.	2.78	0.00	2.78			
	July 15.	1.53	0.41	1.12			
	July 25.	1.47	0.10	1.37			
	Aug. 4.	2.20	0.44	1.76			
	Aug. 14.	2.61	0.45	2.16			
	Aug. 25.	3.88	0.43	3.40			
	Sept. 4	3.93	0.24	3.69			
		18.40	2.12	16.28	270.3	176.3	3.4

Plat No.	Date	Water applied Inches	Wasted Inches	Wasted retained Inches	Yield per acre Bushels	Yield per acre-foot of water applied Bushels	Percentage of small Potatoes Per Cent
	July 10.	1.55		1.55			
	July 15.	0.69		0.69			
	July 25.	2.02	0.05	1.97			
3	Aug. 4.	1.01		1.01			
	Aug. 14.	1.19	0.04	1.15			
	Aug. 24.	1.83		1.83			
	Sept. 4	1.79	0.06	1.73			
		10.08	0.15	9.93	198.6	236.4	7.2
	July 10.	1.22		1.22			
	July 25.	1.81		1.81			
4	Aug. 4.	0.69		0.69			
	Aug. 14.	1.02		1.02			
	Aug. 24.	1.30		1.30			
	Sept. 4	1.52	0.05	1.47			
		7.56	0.05	7.51	210.4	333.9	5.9
	July 10.	2.23		2.23			
5	July 25.	2.88		2.88			
	Aug. 14.	2.06	0.10	1.96			
	Sept. 3	2.98	0.31	2.67			
		10.15	0.41	9.74	234.5	277.2	5.9
	July 11.	2.28		2.28			
	July 15.	1.96		1.96			
	July 25.	3.55		3.55			
6	Aug. 4.	3.30		3.30			
	Aug. 15.	3.30		3.30			
	Aug. 25.	3.07		3.07			
	Sept. 3	2.96		2.96			
		20.42		20.42	265.6	156.1	2.4

In comparison with plat No. 1, plat No. 2 shows a larger yield per acre, but a lower yield per acre-foot of water used. The percentage of unmarketable potatoes produced on plat No. 2 was 3.4 as compared with 4.7 on plat No. 1. Both plats were irrigated the same number of times an on the same dates, but the former received 1.4 times as much water as the latter.

Plat No. 3 was treated to show the effect of the use of less quantities of water than the farmer would have used. This plat received about 0.70 of what plat No. 1 received in the same number of irrigations on the same dates. By comparison with plat No. 1, plat No. 3 shows a decrease in yield of 59.3 bushels per acre and only 16.4 bushels increase per acre-foot of water used. It should be noted that the percentage of unmarketable potatoes was greater than on any other plat.

The results obtained from plat No. 4 show the effect of a less quantity of water than that received by plat No. 3, or about one-half as much as was applied on plat No. 1. A comparison of the yield of this plat with plat No. 1 shows a decrease of 47.5 bushels per acre and an increase of 113.9 bushels per acre-foot of water applied. The percentage of unmarketable potatoes was also higher than in the case of plat No. 1.

The table shows the effect of using 10.15 inches of water on plat No. 5. It was applied with four irrigations separated by a period of about 20 days. As compared with plat No. 3 which received nearly the same quantity of water, the yield per acre and per acre-foot of water used is materially increased. The percentage of unmarketable potatoes is also less. Plat No. 6 was flooded and was intended to be compared with plat No. 1, but the flooding method naturally requires more water than the furrow method and so the irrigator was unable to cover the plat with less water than was used. This fact makes it necessary to compare the results obtained with those of plat No. 2. Although plat No. 6 received about 2 inches more water than No. 2, the yield per acre is nearly five bushels less and the yield per acre-foot of water used was nearly 20 bushels less. One of two things seems to be evident, namely; that the furrow method is better for potatoes than the flooding method or that 20.42 inches of water is too much water under existing conditions for the best results. It should be noted that the percentage of small potatoes was less on plat No. 6 than on any other plat. From a general inspection of the

table, it would seem that within the limits of this experiment that frequent heavy applications of water produce the largest yield per acre and a greater percentage of marketable potatoes.

These facts naturally suggest the question as to whether it would be better to obtain the maximum yield per acre or the greatest yield per acre-foot of water. As an example, suppose there is an excess of land and that the value of the unmarketable potatoes is so small that it may be neglected. It has been carefully estimated that the cost of producing one acre of potatoes is 72 bushels. Comparing the amounts of water applied on plats Nos. 2 and 4, it will be seen that 2.42 acres of land irrigated as was plat No. 4, could be irrigated with the volume of water applied on one acre of plat No. 2. The yield per acre of marketable potatoes on plat No. 2 was 261.1 bushels. Deducting 72 bushels, the cost of production, leaves 189.1 bushels net yield. The yield per acre of marketable potatoes on plat No. 4 was 198 bushels, but 2.42 acres of plat No. 4 could be irrigated with the same volume of water as was used on plat No. 2. So the gross yield for the same volume of water as was used on plat No. 2 would be 479.16 bushels. The cost of producing 2.42 acres of potatoes would be 174.2 bushels, which, when subtracted from the gross yield, would leave 304.9 bushels as against 189.1 bushels where the water was used as on plat No. 2. On the other hand, if there is a surplus of water, and the aim is to get a maximum yield, the crop should be treated more nearly as was plat No. 2.

Summary.

Although the experiments were only made during one season, some facts have been establishel as shown by the various tables, while more extended investigation of the same nature is needed for the intelligent solution of other problems. As to whether it is better to obtain the greatest yield from a given area or produce the maximum yield from a given volume of water, must depend on the conditions which surround the individual farmer and therefore he must solve his own problems, using such experimental data as he may be able to obtain as his guide.

IRRIGATION INVESTIGATIONS, 1906.

By W. W. McLaughlin

For the purpose of making observations on the practical use of water in the vicinity of Ogden, the Perry Canal system was

selected. This canal irrigates about 500 acres planted to crops varying in nature from the tender vegetables to the hardier fruit trees. The soil is for the most part sandy loam but there are small areas of clay and light sand.

The Weber canal system was selected as typical of a large area of land to be found in Morgan county. This system covers some 400 acres of soil varying from gravelly bench land to heavy clay land. The area is sown mostly to alfalfa and grain.

Both of these canal systems were equipped with weirs placed in the main canals and in the laterals. Measurements of the amount of water entering the canal, the amount running to waste through the spill or waste-ways, and the amount turned into each lateral, were made. In this way the amount of water used upon each field and the number and dates of the irrigations were determined. The field representative of the co-operators who had this work in charge, visited each piece of land several times during the summer in order to secure all culture notes, yields and other field data. At the end of the season, the records show, besides the amount of water used upon each piece of land, the cost of production and the yield per acre.

It is thought desirable at this time not to discuss these data in detail because they were collected during the unusually wet season of 1906. Only about one-half the usual amount of water was applied, The average results will be briefly give in tabular form. This work should be continued that the average use of irrigation water may be determined.

Arrangements were made for conducting cooperative tests for the purpose of ascertaining the best use of water in irrigation with the State Industrial School, the State School for the Deaf and Blind, the County Poor Farm, the Wasatch Orchard Company, the Amalgamated Sugar Company, and various private individuals at Ogden. The same line of experiments were carried on with farmers in Sevier, Morgan, Box Elder, Cache, Utah and Juab Counties. It is not thought advisable for reasons previously mentioned to discuss all of the results obtained of this year as was done for 1905 but to discuss only the experiments with sugar beets at Ogden and with potatoes at Morgan. It might be added that the numerous rains during the past summer necessitated changes in the details of these experiments throughout

the season, in some instances the number of irrigations contemplated being reduced by one-half.

Precipitation during growing seasons 1905 and 1906.

Month.	Precipitation in Inches. At Ogden		At Morgan.	
	1905	1906	1905	1906
May	1.69	3.86	4.25	5.63
June	0.51	0.84	0.85	1.47
July	0.65	0.11	0.19	0.44
August	0.36	4.27	1.17	4.11
Total	3.21	9.38	6.46	11.65

In the above table the percipitation during the growing months of 1905, which was a year of normal precipitation, is compared with that of 1906. There is no unusual difference in the rainfall during the first three months but at Morgan there was nearly twelve times as much precipitation during August 1906 as during August 1905, and at Ogden almost four times as much. The rainfall of August 1906, would take the place of one or more irrigations as it was fairly well distributed.

Sugar Beet Experiments in Weber County.

Arrangements were made with the State Industrial School to conduct a series of experiments for the purpose of determining the most advantageous use of irrigation water in the production of sugar beets. This farm is located in the north western part of Ogden and is typical of the large area of sandy-loam soils to be found in Weber county used for beet culture. The land is easy to cultivate but requires considerable care in irrigating that the water may be applied uniformly. The underground water during the growing season is found from three to four feet below the surface and this distance represents the depth of soil for plant use.

Soils of this character will not hold a large quantity of water such as will a clay soil, therefore each irrigation should not be so copious but possibly more frequent than on the heavy soil. The irrigation water for this tract is taken from the Ogden River.

The field was divided into eight plats which were to be irrigated according to the following plan.

Plat No. 1.—Check plat—to be watered as suggested by the farm foreman in four irrigations.

Plat No. 2.—To be irrigated four times at the same time as plat No. 1, except the first irrigation of plan No. 1 which is to be omitted on this plat.

Plat No. 3.—To receive ¼ less water than Plat No. 1 in five irrigations.

Plat No. 4—To receive ¼ more water than plat No. 1 in five irrigations.

Plat No. 5.—To be irrigated same as plat No. 4 except second irrigation which is to be applied one week earlier than in plat No. 4.

Plat No. 6.—To be irrigated same day as plat No. 5, and receiving one-third more water than plat No· 1.

Plat No. 7.—To be irrigated same as plat No. 4 except second irrigation to come at time of third irrigation of plat No. 4, thus putting last irrigation two weeks later than in plat No. 4.

Plat No. 8.—Containing seven acres to be irrigated as farm foreman suggests.

All plats to be irrigated by the furrow method and are to be cultivated on same days.

The following table is self-expanatory.

Plat	Amt. of water applied, acre-feet	Yield in tons per acre	Number of Irrigations	Number of Cultivations	At $4.50 per T. Increase or decrease by Irrig. as in Plat No. 8	Area irrigated in acres by using method of plat No. 8
1	2.38	26.5	4	5	loss $ 7.48	1.26
2	2.30	26.2	4	5	" 8.51	1.22
3	1.89	21.5	5	5	net	1.00
4	3.12	23.75	5	5	gain 27.32	1.65
5	2.78	27.30	5	5	" 1.15	1.47
6	3.67	27.40	5	5	" 27.54	1.94
7	2.59	21.90	5	5	" 19.53	1.37
8	1.60	19.20	6	5	loss 7.88	.84

The last two columns well be explained in the following discussion:

An inspection of the table shows that with the exception of plat No. 4, the yield increases with the amount of water applied. There is but a slight increase in yield in plat No. 6 over plat No. 5, although about one-third more water was used. This suggests, as was demonstrated in the work at Logan, that there is a limit to the amount of water to use in growing sugar beets. When this limit is reached applying more water will decrease the yield. It is apparent from the table also that with the smaller amounts of water applied a slight increase of irrigation very materially increases the yield, while with the larger amounts the increased yield due to additional water is not so marked. In other words **the productive value of an inch of irrigation water depends upon the amount of water which has already been applied during the** season, decreasing with additional amounts until finally there is reached a point where additional irrigation decreases the yield. We may illustrate from the above table. In plat No. 8, the productive value of 1.6 feet of water is 19.2 tons, or one ton per inch of water used. In plat No. 3, three inches more water was applied than in plat No. 8, but the increase in yield was only 2.3 tons of beets or about 0.8 tons per additional inch of water. In plat No. 2, five inches more water was used than in plat No. 3, increasing the yield 4.7 tons, or about 0.9 tons per additional inch of water used. In plat No. 1, one inch more water was used than in plat No. 2 and 0.3 tons more beets produced, or 0.3 tons per additional inch of water. In plat No. 5, four and eight-tenths inches more water resulted in an increased yield of approximately 0.2 tons per additional inch of water. Plat No. 2 gives the highest productive value per inch of water applied, but as plat No. 3 more nearly represents the method of irrigation to be recommended it will be used in the following discussion. As has been previously stated it is the greatest value of water that we are determining, therefore, the question is what would be the financial results had all the water been used as on plat No. 3? This plat received 1.89 feet of water and the 2.38 feet of water used in plat No. 1, would have irrigated an area of 2.38 divided by 1.89, or 1.26 acres. Now the yield of 1.26 acres figured on a basis of the yield on plat No. 3 would be 1.26 times 21.5 tons (the yield of plat No. 3), or 27.09 tons which at $4.50 per ton gives $121.91. It cost to produce an acre of beets $39.40, and to produce 1.26 acres it would cost $49.64. Substracting this amount from the total yield $121.91,

gives a net yield of $72.27. The same amount 2.38 feet of water, applied to one acre as in plat No. 1 produced 26.5 tons of beets valued at $119.25, and it cost $39.40 to produce them, leaving a net profit of $79.85. A comparison of the net profits found above, shows an increase of $7.58 for the last one. Had we used the amount of water applied to plat No. 1 on an increased area irrigated by the method of plat No. 3, there would have resulted a loss of $7.58. This amount is to be found in next to the last column of the table. Had we used the 2.3 feet applied to plat No. 2 on an increased area as was done in plat No. 3, there would have been cultivated an area of 1.22 acres at loss of $8.51, but had the 3.67 feet of water used on plat No. 6 been used as on plat No. 3, 1.94 acres would have been cultivated at a net gain of $27.54.

The seventh or last column in the table gives the area which could have been irrigated by using the water as was done in plat No. 3, and the sixth column gives the resulting net loss or gain. This loss or gain includes all the work incident to growing and marketing the beets such as plowing, seeding, cultivating, irrigating, digging, and hauling to the factory. There are included five days team work at $3.00 per day and 12 days hand labor at $1.75, or a total of $36.00 for labor. It must be kept in mind that these results are for one year only and an abnormally wet year.

POTATO EXPERIMENT—MORGAN COUNTY.

The soil of Morgan county varies from the heavy clay in the bottom lands to light gravelly soil underlaid with coarse gravel on the benches. For the purpose of this experiment it was decided to secure a medium clay-loam soil and arrangements were made with Mr. W. H. Rich to use part of his farm lying one and one-half miles southwest of Morgan City. This soil is rather uniform in character with the underground water more than ten feet below the surface which insures a good deep soil. Land of this character will hold a large quantity of water but requires considerable cultivation that "crusting" may be prevented after rains or irrigation.

The following ouline gives the plan of the experiment.

Plat No. 1.—To be irrigated twice as often as plat No. 4, applying in all about the same quantity of water to these plats.

Plat No. 2.—To be irrigated twice as often as plat No. 4, applying in the four irrigations about one-third more water.

Plat No. 3.—To be irrigated three times, using the same amount of water as on plat No. 2.

Plat No. 4.—Check plat, to be irrigated as farmer suggests.

Plat No. 5.—To be irrigated three times using one-half the amount of water at each irrigation that is used each time on plat No. 4.

Plat No. 6.—To receive four irrigations, applying the same total amount of water as applied to plat No. 4 but using a large stream and hurrying the irrigation.

Plat No. 7.—A four acre field handled by the farmer.

All plats to be irrigated on the same day and to receive the same cultivation.

The following table arranged as the preceding table is self-explanatory.

POTATOES—MORGAN.

Plat	Amt. of water applied, acre-feet	Yield in bushels per acre	Number of Irrigations	Increased value of crop, by irrigating as in plat No. 1	Area irrigated employing method used on plat No. 1
1	1.60	325.5	4	Net	1.00
2	2.14	282.1	4	$ 63.46	1.34
3	2.17	205.4	3	104.27	1.36
4	1.64	227.4	2	50.53	1.02
5	1.47	256.8	3	23.29	0.92
6	1.79	250.2	4	50.74	1.12
7a	1.60	141.3	2	169.69	1.63

A plat 7 was severely injured by frost and made a poor stand.

An inspection of the table shows that the yield was greater with four irrigations than with three or two although more water was applied in the latter case, further that with four applications the smaller amounts of water gave the greater yield, as shown in comparing plats Nos. 1, 2, 3, and 5. It was noticed during the growing season that plats Nos. 2 and 3 did not look as thrifty as Nos. 1 and 5, although treated the same and with no difference in

the soil which could be detected. Plats Nos. 4 and 7 cannot be compared as there was a considerable difference in treatment and in "stand" which accounts in part for the great difference in yield. It appears from this table also that in the case of plats Nos. 1, 2, and 6 which received four irrigations the maximum yield from these plats as affected by irrigation water was passed when 1.79 acre feet of water were applied and that a greater yield would have been secured had less water been used. 1.79 acre feet of water applied in plat No. 6 gave less potatoes than 1.60 acre-feet applied in plat No. 1, and that probably a greater yield would have resulted by using less than 1.60 acre-feet. That is, in these plats with four irrigations, water was applied in such quantity, that the yield was reduced rather than increased. In the same way for three irrigations as applied in plats Nos. 3 and 5 there was a decrease in yield by using too much water. The point of productive value of the irrigation water was passed, a condition often found in practice and one to be avoided as it entails a financial loss as well as a waste of water.

Had we irrigated all the plats by the method employed in plat No. 1 there would have resulted a cultivated area in each case as shown in the last column of the table and a corresponding financial gain as indicated in the fifth column.

Applying four or more irrigations and using a small amount of water at each irrigation would in this instance have given the greatest returns.

These results like the preceding are for an unusually wet year.

Practical Use of Irrigation Water.

Measurements were made of the amounts of water used by the farmers as actually applied to different fields and to various crops. The following table gives some of the results.

AVERAGE USE OF WATER IN PRACTICE.

Weber County.

Crop	Nature of soil	Water applied acre-feet	No. of irrigations	No. of cultivations	Yield per acre
Alfalfa	Clay	0.77	2		3.22 tons
Alfalfa	Sandy	0.83	3		4.28 tons
Alfalfa	Bench	5.10	7		4.80 tons
Oats	Clay	1.70	4		50 bu.
	Sandy	1.02	2		51 bu.
Potatoes	Clay	1.44	4½	3	162 bu.
	Loam	2.00	6	4	200 bu.
	Sand	2.71	7	5	144 bu.
Wheat	Clay	1.57	2		27.3 bu.
	Loam	1.27	3		25.0 bu.
	Sandy	2.05	3		24.3 bu.
Sugar Beets	Clay	1.34	2	4	17.5 tons
	Loam	1.10	4	5	20.9 tons
Carrots	Sandy	1.4	12	4	2100 lbs.
Peas	Loam	1.32	4		24 tons
Onions	Gravelly	1.76	4	7	556 bu.
Onions	Sandy	2.40	6	2	786 bu.
Onions	Clay	1.78	8	4	480 bu.
Tomatoes	Sandy	1.86	9	7	14.2 tons
Asparagus	Sandy	0.44	6	11	0.604 tons
Peaches	Sandy	1.40	2	3	9½ tons

Morgan County.

Crop	Nature of soil	Water applied acre-foot	No. of irrigations	No. of cultivations	Yield per acre
Sugar Beets	Clay	0.85	4	2	13.7 tons
Oats	Clay	0.55	2		65 bu.
	Loam	2.16	1		60 bu.
Potatoes	Loam	1.64	2	4	158 bu.
	Sandy	1.57	3	3	198 bu.
	Bench	2.60	2	4	142 bu.
Wheat	Loam	0.83	1		37 bu.
	Clay	1.53	3		32 bu.
Alfalfa	Loam	1.47	2		4.38 tons
	Sandy	2.45	7		2.46 tons
	Bench	5.03	4		3.83 tons
Apples	Loam	0.75	3	5	90. bu.

The soils of Morgan Valley are more porous and have greater available depth than the soils adjacent to Ogden and it would be expected that more water would be required by the former. However, this year most water was applied to the crops at Ogden with the yield per acre in favor of Morgan, except for alfalfa. It is generally believed that the farmers adjacent to Ogden practice more careful irrigation than the farmers in the Morgan valley, where water is more plentiful. This year's results do not justify that belief when we consider only the water actually applied to the crops, but when the amount of water carried by the canals is taken into account, it is found that the Morgan farmers divert from the river considerably more water per acre than do the farmers at Ogden.. This is accounted for from the fact, that night as well as day irrigation is practiced in Ogden and generally only day irrigation at Morgan. In the latter case the water is allowed to run through the canals and laterals back into the river during a part of the twenty-four hours. Whether this results in a waste of water, the writers are not prepared to say, but they believe better results would be obtained by practicing irrigation

througout the day and night, for the reason, among others. that a larger area could be brought under one canal, thus reducing the annual water tax per acre, probably decreasing the seepage and evaporation loss per acre of land irrigated and lessen the waste of time in irrigating. The writers are convinced that larger yields would be obtained by having the "water turns" come oftener, which is possible if irrigation be practiced twenty-four hours each day.

The records show for Morgan that the Weber canal diverted enough water to have covered the 400 acres irrigated to a depth of 4⅛ feet, while an average of less than two feet was actually applied to the crops. Without this last record, it would appear than an excessive amount of water was being used under the Morgan canal and would afford opportunity for other canal companies to complain of the excessive use of irrigation water by the Weber canal.

It may be added in discussing the practical use of water as investigated the past season, that the productive value of an inch of irrigation water depends upon the time of its application as well as on the amount previously applied; that in general the productive value decreases with the total amount used until finally there is reached a point where if more water be applied the yield will be decreased. This limit for crops upon gravelly soils is high and not well defiend, while for clay soils the limit is comparatively low and fairly well defined.

WINTER IRRIGATION.

"Winter Irrigation" or the application of water to land during the non-growing season has become recognized in many of the western states as a potent factor in agricultural extension. In Utah, we have large quantities of water running to waste during the time between the close of one irrigation season and the opening of the next. This water is wasted not for the lack of additional land to irrigate, but for the lack of storage facilities. The irrigated area can be increased in proportion to the amount of water available. If then, part of this waste water could be retained in some way for irrigation of crops by just so much would the cultivated area increase. Experiments have shown that water can be stored

in the soil for some time by proper methods of cultivation. Winter irrigation consists of running the otherwise waste waters upon the land during the fall and spring to be reservoired within the soil for plants use during the following growing season.

Little has been done in an experimental way for the purpose of determining the proper time and amount of water to apply in winter irrigation and to what extent the practice is beneficial. It was thought advisable, therefore, to undertake some investigations along these lines, particularly in connection with dry land agriculture. A considerable area of land could be winter irrigated for which it is impossible to secure water during the growing season.

Arrangements were made to conduct this work in Box Elder, Tooele and Sevier Counties. The following is an outline of the experiments now being conducted with fall irrigation in the vicinity of Garland.

Outline for Winter Irrigation Experiments.

For these experiments is desired, unless otherwise noted, an area of from five to twenty acres. Before any field is selected, the depth to ground water, hard pan or gravel, if within eight feet of the surface should be determined and in no case are these experiments to be conducted on soil where the gravel or ground water is within four feet of the surface. It is desirable to experiment with as many of the following crops as possible: Grain, alfalfa, fruit and beets.

Grain Fall Planted—To be irrigated heavily in the fall and again the following spring. If, after the fall irrigation, the surface becomes dry enough, the field is to be harrowed with the spring-tooth harrow.

Land for Spring Grain.—To be irrigated heavily, followed if possible with the disk and spring-tooth harrow.

Alfala Fields—To be irrigated heavily and if of rather a thin stand is to be cultivated with the disk harrow; if of medium heavy stand, to be cultivated with the spring-tooth harrow.

Note: Alfalfa fields upon which seed is to be raised are not to be cultivated with the disk harrow.

Orchards—Irrigate heavily, keeping the water at least three

feet from the tree, to be followed as soon as possible with disk and spring tooth harrows.

Beet land—Apply light irrigation, let stand three days and apply heavy irrigation. Follow with the spring-tooth and disk harrows as soon as possible.

Land for Dry Farm Grain—If the grain is fall planted and is now up, the land should be irrigated thoroughly and again in the spring. On a second field is to be applied a spring irrigation only. In each of these two experiments an area of two acres is desired.

In all these experiments, notes are to be taken of irrigations and cultivations, growth, yield and cost of producing the crop.

The water is to be applied in furrows four to five feet apart and in all cases it is desirable to use a small stream in each furrow.

The results of this work will not be apparent for another year and hence no further discussion is advisable at this time.

In addition to the experimental work in winter irrigation, information is being collected on methods of winter irrigation as practiced by individual farmers.

It is a prevalent practice where water is scarce to "fall irrigate" the alfalfa land but with few exceptions no other attempt has been made to apply irrigation water in the fall.

ADDITIONAL INVESTIGATION DURING 1906.

In addition to the work reported in this bulletin, systematic investigations are being made of the methods of canal management and water distribution as practiced in the State. The object of these inquiries is to determine the best practice of canal management and water distribution and then to recommend the same to the different canal companies. It is a well established fact that the better managed canals secure a higher duty of water than do those poorly managed. There are a great many devices now in use for the distribution of the water from the canals to the laterals, very few of which are satisfactory. In a majority of cases the shareholders nearest the head gate secures the greatest amount of water per share while the farmer at the lower end of the canal in some instances secures less than half his proportion of the water.

It has developed from our inquiries in a great majority of cases that where the annual water tax has increased during the past five years it has been caused by litigation. This litigation is the result in most instances of a lack of a system of apportioning the water of the stream among its several appropriators. There has been outlined and is now in force an agreement which was suggested by the irirgation engineer of the station for the distribution of the water of Logan River among the several canals taking water therefrom. The results of the work under this agreement will be watched and reported at a later date. The agreement was entered into mainly for the purpose of averting litigation and for mutual protection against future water appropriators from this stream.

Information is also being collected upon the building and constructing of small reservoirs by individuals for the purpose of recommending to the people the best practice in the building of small reservoir dams for the storage of water.

Investigations are now under way on the effect of the application of irrigation water on the rise and fall of the under-ground water in the various agricultural sections of the State.

We are spending considerable time visiting sections in which irrigation is being practiced for the first time in order to assist in establishing a system of irrigation which will be for the ultimate good of the new settlers. It is found that this work is very beneficial and much appreciated. The aim of these investigations is to be of service to the agricultural interests of the State in every way possible and particularly to guard against future evils which may result through improper methods of irrigation and drainage. The Utah Experiment Station stands ready at all times to render assistance to any community of the State.

REPORT OF DRAINAGE INVESTIGATIONS AND EXPERIMENTS IN UTAH DURING THE YEARS 1905-6.

[By C. E. Elliott

An act of the Utah State Legislature approved February 21, 1905, appropriated $5,000 annually for the years 1905 and 1906, for investigations and experiments in irrigation and in the re-

clamation of alkali and water-logged lands in the State, on condition that Irrigation and Drainage Investigations of the U. S. Department of Agriculture appropriate a like amount for the purpose. The act stipulates that the work shall be planned and executed jointly by the Utah Experiment Station and Office of Experiment Stations of the Department of Agriculture. By the terms of the cooperative agreement mutually arranged by these parties, $3,000 of the joint appropriation was to be used for drainage investigations and experiments in 1905, and $4,000 in 1906, the work to be under the immediate supervision of the Irrigation and Drainage Investigations of the Office of Experiment Stations, reports to be made to the State Station. The report herewith submitted covers the work conducted in the State in accordance with this agreement and gives the results thus far obtained.

The necessity for ascertaining some practical method of reclaiming water-logged and alkali lands, which furnished the occasion for the appropriation made by the State, has been greatly emphasized by further investigations. There is scarcely a locality where irrigation is practiced which does not include a considerable area of land once profitably cultivated but now either wholly abandoned or indifferenly productive from this cause. This state of affairs works a great hardship upon many farmers and in some instances has so reduced the value of their lands that they are poorly able to undertake a work involving much expense in bringing about a betterment of their conidtions. Such efforts are not likely to be made whenever there is a doubt about the success of the undertaking. These areas are found from Cache County on the north to Washington County on the south, under a great variety of climatic and soil conditions. In some cases they are distant from railroad facilities and supply points, and in every case a local investigation or experiment is necessary to ascertain the requirements in each section.

A preliminary review of the situation in the State has led to the conclusion that the first steps to be taken should be of a practical nature with a view of finding a method of drainage which farmers could put in practice without delay. The constant annual increase in the acreage of water-logged land and its train of ruin in every district suggested dispatch in the preliminary work. It also suggested the wisdom of co-operating with the farmers in the several localities where investigations were asked for, to

bring about quicker results. By this means farmers would become personally interested and the results accruing from the work would be better received than if the Department or the State should carry on the work independently. Besides this, any experimental work in drainage would be of more or less benefit to the land operated upon for which the owners should be willing to pay. While there are scientific questions connected with this work requiring investgations, the practical features come first and appeal more strongly to the farmer.

Hyde Park, Cache County.

In 1904, one year previous to the beginning of cooperative investigations with the State, the office of Irrigation and Drainage Investigations cooperated with three farmers of Hyde Park, Cache County in an experiment to drain fields which formerly had been used for the growing of wheat, beets, and alfalfa, but of late years had been abandoned to timothy and clover on account of the subirrigation, which had rendered them unfit for cultivation. Upon examination it was found that those fields were a part of a belt of land lying between Hyde Park and Logan, near the foot of the main irrigated bench, a large part of which had become too wet for cultivation and in some cases produced only water grass. This strip of land, estimated at 2,000 acres, had the reputation of once being the most valuable land in the valley. The wet area was gradually extending itself towards higher ground and encroaching upon fields suitable for the growing of beets, which crop is one of the most profitable produced. Detached fields and parts of fields occupying higher ground were found in a similar condition. This land rarely showed injury from alkali, though many thousand acres upon the flats nearer the river, possessing a different soil, are badly alkalied and used only for grazing purposes.

The soil of the fields which required drainage, consists of a black loam underlaid with yellow clay, both of which are of an open nature and permit the passage of water quite freely. It was noted that when the fields upon the upper bench land, one-half to three-quarters mile distant and 50 or more feet higher, were irrigated, the waste soil-water appeared on the lower levels about 36 hours later, indicating that the primary cause of the wet con-

dition of the lower lands was the waste from the more elevated fields. Owing to this the lower lands were not irrigated. For a time this was a welcomed convenience for their owners, but later the wetness of the soil increased beyond the point required for producing cultivated crops.

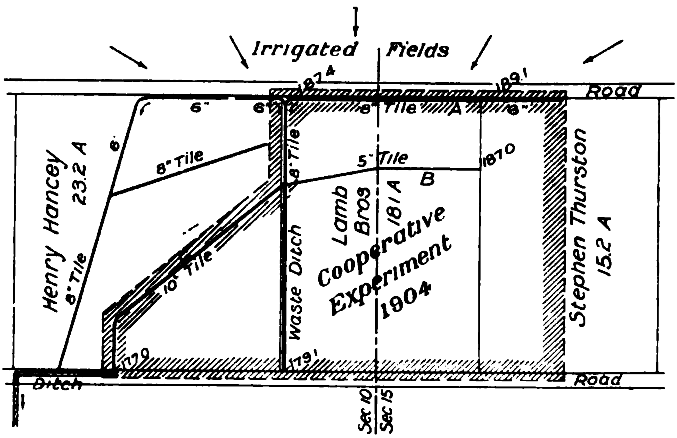


Fig. 1—Tile Drainage Experiment at Hyde Park, Cache County, Utah.

A plan (fig. 1) was made for draining a field of 30 acres, requiring the use of a tile drain (A A) 4 feet to 5 feet deep, placed nearly parrallel to the upper edge of the wet portion of the field. This was constructed of 8-inch and 6-inch drain tile and discharged at a depth of 3 feet into a waste ditch, which was deepened for the purpose. A second drain of 5 inch tile (B) was made in the interior of the field, at the lower border of the saturated belt and where water accumulated when applied directly to the field. The latter was only 3½ feet deep. By agreement with the owners, the office furnished the tile for the work at the Hyde Park railroad station, the farmers agreeing to do all work connected with putting in the drains and granting the office the right to use the field for drainage experiments. The accompanying plat (fig 1) represents the location of the drains and the surface condition of the land upon which the work was done. The owners being unable to maintain the waste ditch outlet at the depth required to afford a satisfactory outlet for the tile, drain C was laid the following summer, it being 4 feet deep at the discharging point of the drains previously laid, and two feet deep where it discharges

into the waste ditch at the road. The grade is 0.4 foot per 100 feet. The effect of this better outlet was to reduce the permanent water level in the field to within six inches of the bottom of the drains and also give complete drainage to the portion of the field crossed by drain C, which before its construction was wet.

When the trenches were dug it was noticed that water entered them freely through crevices and channels of the soil, some as large as a lead pencil, and that when the trench was finished the supply through the bottom was constant. The subsoil is granular clay, somewhat stratified and sufficiently open to admit the moderately free passage of water. It may on the whole be regarded as a soil for which tile or other underdrains are well suited, there being sufficient clay to prevent the entrance of silt or sand. There are, however, occasional sand pockets encountered, which, when filled with water, give difficulty in making the drains.

Preceding and following the construction of the drains, a study of subsoil water conditions was made by aid of soil-water wells established for the purpose. A record of the fluctuations of the water table was kept from which the movement of water and the effect of the drains was determined. It seems conclusively established that the saturation of the lower lands results from the irrigation of fields on the higher levels, and that the water passes through the soil along the line of greatest surface slope until it reaches the more level sections, where it accumulates. Owing to the structure of the soil, ground water passes more readily through some parts than others, thus giving the water an uneven distribution, causing wet spots rather than a uniformly saturated condition of fields as might be expected.

The following brief statement of data collected, results obtained, and conclusions reached, is of value to farmers owning wet land in that region. Two conditions should be considered in locating the drains in lands of this class. First, a drain should be located to intercept the soil water from the higher benches and should be placed across the slope near the line between the dry and wet land. This may be 50 feet down the slope from the upper edge of the land showing wet. Second, a drain should also pass through the land showing the greatest degree of wetness. This is required for the reason that the method of irrigation employed fills up the lower soil more rapidly than it will take care of the

surplus, requiring a drain to supplement natural drainage in removing waste irrigation water. The latter will not take the place of the former, but in some instances the intercepting drain will fully dry the field, depending much upon the surface contour and subsoil of the wet land.

A depth of not less than four feet appears to give best results. A greater depth is to be preferred and may sometimes be necessary, but considering the difficulty of maintaining outlets and the cost of digging the trenches, it is probable that this is the most practical depth. The flow of water through the drains is much greater during the first season after construction than later. Under the conditions described and owing to the subsequent construction of other drains, eight inch tile instead of 10 inch tile could be used on drain C, and six inch instead of eight inch on drain A. It is not best to use smaller than five inch tile for any drain for the reason that there is always a possibility of the entrance of silt from sand pockets in the soil and it is sometimes desirable to admit waste water from the surface and also to flush the pipes from an irrigation ditch.

It is noticed that in the method of irrigating here employed, water fills the soil in the low places at every irrigation, under which condition an underdrain is required to remove the surplus. No special difficulty arising from irrigation water washing holes in the soil to the drains was encountered after the first year, though constant watchfulness is required at such times to prevent injury of this kind. Excavating the ditches cost, as reported by the farmers who did the work, 40 cents per rod for the smaller ones and 50 cents for the larger ones, where the depth does not exceed four feet. The drain tile cost at the Hyde Park railroad station as follows:—5-inch, $58; 6-inch, $75; 8-inch, $120; 10-inch, $182 per thousand feet.

The fields represented on the plat are thoroughly drained by the lines shown. Fifty bushels of wheat and 100 bushels of oats per acre have been grown upon such portions as were plowed, and 18 tons or more of beets were grown in 1906 upon all the land planted to this crop, which was about 25 acres. A further effect of the drains is the improvement of the wet land adjoining the drained fields on the lower side. The work is being extended by farmers who wish to restore their wet meadows to wheat, beet, and alfalfa fields, some putting in temporary brush drains, and

the more laboriously made stone drains, which for the present are attended with a fair degree of success.

There is a tendency on the part of farmers to neglect the following essential points in constructing tile drains. The bottom of the trench should be accurately graded and if possible upon a slope of not less than 2½ inches to 100 feet, though one-half that grade may be used as a minimum. If sand pockets are encountered, clay or soil should be filled in until a firm bed is secured upon which to place the tile; if this method fails, use a board for the bottom, cover the tile with the most compact clay obtainable and compact the entire filling of the trench by tamping thoroughly with the feet for the first 18 inches above the tile, and then by a log drawn by a team back and forth in the trench as filling proceeds. Every means should be taken to prevent irrigation water from passing through the trench filling more readily than through the natural soil on either side of it.

Cooperative State Investigations.

Pursuant to the agreement between the State Experiment Station and Irrigation and Drainage Investigations before referred to, Mr. Charles F. Brown, drainage engineer of the latter office was placed in charge of field operations under the direction of the main office, and began work July 9, 1905. Additional drains were laid out at Hyde Park for farmers who wished to extend the work previously shown to be successful, but no further assistance was rendered in that locality.

Correspondence received at the State Experiment Station from citizens of Castle Valley in Emery County, represented that region to be badly in need of drainage, and requested assistance under the provisions of the State appropriation for drainage. A personal inspection of the fields showed conditions which merited attention and demanded prompt relief if such be devised. The settlements at Huntington, Orangeville, Castledale, and Ferron, include lands in all stages of ruin from the field just beginning to "swamp" to the desolate bogs whose miry depths are concealed by snow-white alkali during the dry season of the year. It is safe to say that 30 per cent of the land formerly under irrigation and cultivation is now practically valueless, being either charged with alkali or boggy. Town gardens and outlying fields are alike in this respect. The general appearance and condition of the land

is similar at all of the points named. These changes have been going on for ten or more years and portions of fields are yearly added to the abandoned area.

The Huntington area is fairly representative of the valley and was selected for special examination and experiment. Mr. Edward L. Geary, the owner of the S. W. ¼ of S. E. ¼ Sec. 25, T. 16 S., range 8 E., S. L. B. and M. agreed to do the necessary trenching if this 40 acres should be selected for the experiment. The Board of County Commissioners appropriated $200 towards the project. The above described 40 acres lying one mile south of the town of Huntington shown on the contour map by (fig. 2) was selected as representing one of the most difficult areas to

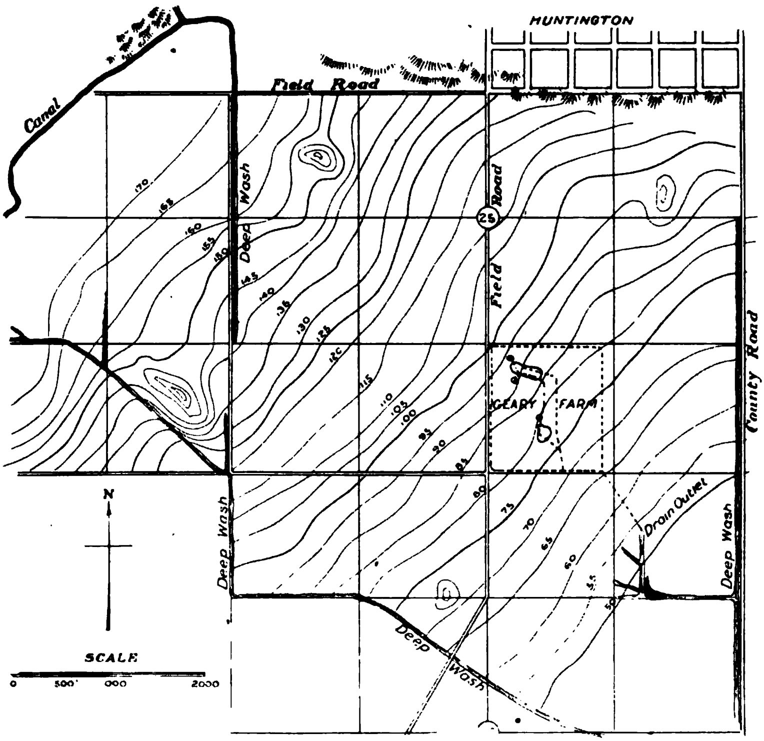


Fig 2—Contour Map of South Huntington Field, T. 16 S., R. 8 E.

drain. Mr. Geary, the owner, was to do the trenching, estimated at $300, the balance of the cost to be paid from the joint Federal

and State funds with the exception of $200 appropriated by the County, which was also to be applied to this work.

A soil survey of the tract made by Mr. A. T. Strahorn of Bureau of Soils, describes the soil as a loam, a part of which contains some fine sand and is called a fine sandy loam. It is underlaid with a hardpan of a black shale nature, 18 inches to 10 feet beneath the surface. The hardpan in some places is hard and black when first taken from the ground. After being exposed a few days the blocks take on a gray color and soon become covered with a coat of soluble salts. Longer exposure results in the complete breaking up of the mass, forming finally a heavy soil usually carrying much alkali. The report further says that this structure and alkali content of the hardpan is responsible for the alkali and water-logged condition of the land.

The field in question contained three bogs, where the hardpan is found 18 inches from the surface, to which the water rose continuously and flowed away and played no small part in keeping the surrounding soil saturated. It is evident that the water has its source in the higher irrigated lands lying at the north and west of the field, which as will be seen by referring to the map slopes southeasterly toward the Geary tract at the rate of 60 feet per mile. The water used for irrigating is taken from the Huntington river, and according to the soil survey contains 56 parts of total salts in 100,000, of which much the larger quantity consists of sulfates. It is also authoritatively stated that there is no black alkali on the land. The following is the survey's analysis of the alkali crust found on the land:—

Composition of Alkali Crust.

Names	Per Cent.
Calcium sulfate	4.72
Magnesium sulfate	26.80
Sodium sulfate	65.49
Potassium chloride	0.67
Sodium chloride	1.75
Sodium bicarbonate	0.57
	100.

About 40 per cent of the field shows over 1 per cent of total salts in the first six feet, and a larger per cent contains over 1 per cent in the upper twelve inches. The preceding notes taken from Mr. Strahorn's report and other examinations made preliminary to drainage operations show that the soil of the tract was highly charged with salts, that these were largely derived from the hard-pan and soil itself, and that the water which produced the wet condition of the land came from the higher elevation at the north-west by percolation through shale strata and soil.

The following plan of draining the tract seemed to promise the best results (fig. 3). A drain was placed upon the north and west sides to intercept the soil water which came upon the north

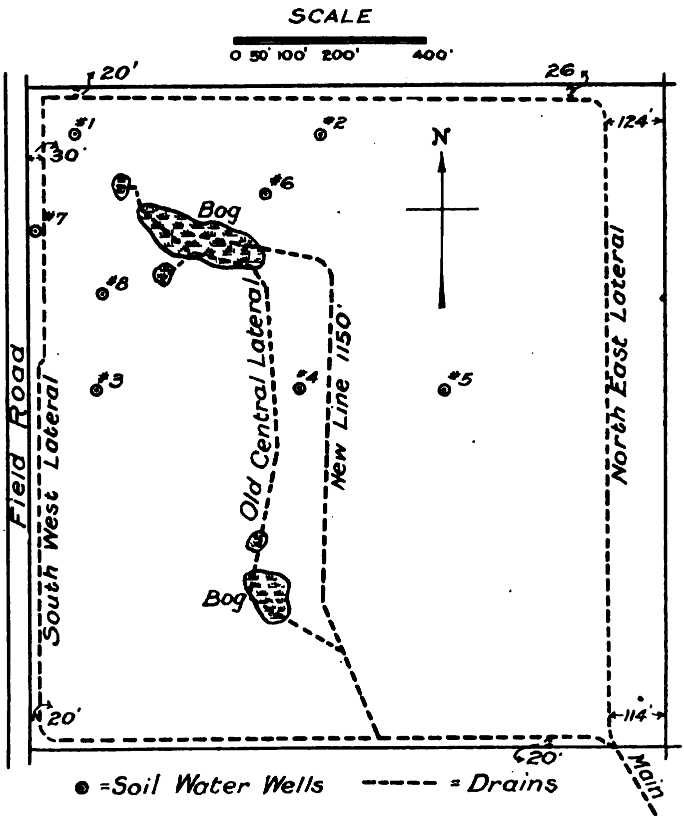


Fig. 3—Map of Drains and Wells, Geary Farm, Huntington, Utah.

and west side, to intercept the soil water which came from the irrigated lands above it, and another through the interior to drain the shale bogs which appeared to receive their water from some distant source. This plan required a drain to surround the tract in order to secure a point of discharge for the drains. Besides the drains affecting the field direct, it was necessary to make 740 feet of drain to reach a wash into which to discharge the drainage water of the field. Lumber was the only material available for drains and was hauled from mills in the mountains 25 miles distant. The outlet drain was made of plank 2 inches thick, the sides were made 8 inches wide, and top 12 inches wide, making an opening of 8 inches by 8 inches. Other drains were made of lumber 1 inch thick, sides 6 inches wide, top 8 inches, making an opening of 6 by 8 inches. Ordinarily there were no bottoms except tie cross pieces placed 4 feet apart, though where the earth was extremely soft boards were placed on the bottom of the tie

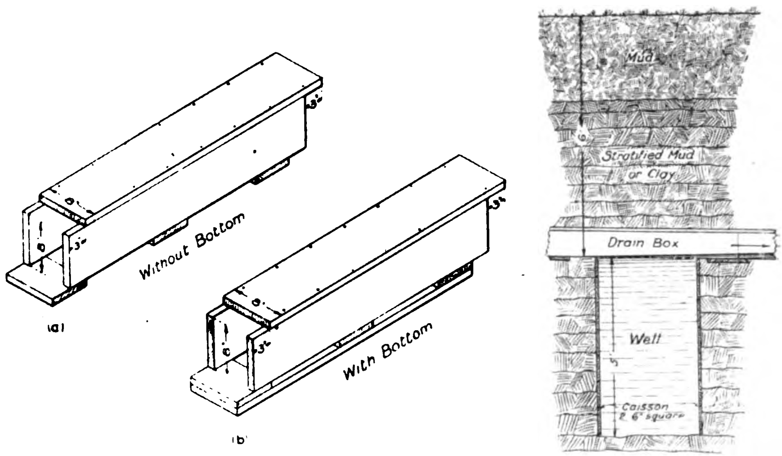


Fig. 4—(a) and (b) Drain Boxes Used on Geary Farm.
(c) Section of Relief Well.

pieces (a and b Fig 4). The plan was to place the drains between 4 and 5 feet deep. The trenching was easily done where the ground was moderately dry, but on the north and west sides and through the interior the utmost difficulty was experienced. It was necessary to curb the sides with plank in order to put the drain boxes in place. The mud was so thin that it filled the

boxes from the bottom and bottom boards were used to prevent it. The land between the interior shale bogs was so wet that it was impossible to lay the drain deeper than 3 feet. The bog spots, however, were penetrated 5 and 6 feet deep as the shale in them, with the exception of the top 2 feet, was hard, requiring the use of the pick in excavating portions of it. Water flowed into the ditch freely through the crevices on the side and from the bottom. The ditch was dug 6 feet deep in the north bog but water continued to come up from the bottom. A relief well (C Fg. 4) was sunk 4 feet below the drain from which water rose and passed off through the drain, showing that a part of the water which supplied the bog came from a depth of 10 feet. Such difficulty was found in excavating the ditch in the soft ground that a stream of water was turned from the irrigation ditch and permitted to wash away the soft soil. While this method made a large ditch, it enabled the workmen to place the boxes perfectly.

Difficulty was found in making the north 600 feet of the west drain, a section where the water from the west appeared to enter the field in larger quantities than elsewhere. The workmen were unable to make the ditch deeper than 4 feet or to place the boxes properly owing to the almost fluid nature of the earth at this section.

Soil water wells were established as shown on the plat, by means of which the postion of the water line and effect of the drains could be followed. During the fall of 1905 and spring of 1906 the well showed that the ground water stood too high in many portions of the field. An examination of the drain on the west side revealed the fact that in addition to its being too shallow, the mud had pressed into it from the bottom and filled it. The condition of the soil was such that it could not be cleaned or relaid. The water method of cutting ditches was again resorted to and a trench parallel to the drain was cut a little at a time to a depth of 6 feet during the summer of 1906. The effect of this was to dry up the water in all of the test wells and to complete the drainage of the field with the exception of the lower portion of the north bog, wher the drain was shallow. Boxes with bottoms will be laid in the "washed" ditch and it will then be filled. In October 1906 the field was sufficiently dry to plow. The ground at this writing (November 1906) is in such a condition that the interior drain between the bogs can be placed 4½ feet deep as origi-

nally intended, and arrangements have been made to do it the present fall, as it is feared that the central drain is not deep enough except through the bogs, to give permanent drainage to the interior of the field.

The backfilling of the trenches was done with team and plow after the boxes had been carefully covered with earth and tamped by hand labor. Mr. Geary had great difficulty in irrigating because the water entered the trenches readily and soon washed a hole into the drains. If practicable the trenches should be filled when the earth is moist or wet and great pains taken to compact it thoroughly. In any event the trench must be watched with vigilance, especially during the season following the construction of drains. In the Yakima Valley, Washington, irrigation of drained land is much faciltiated by conducting the water across the drains through temporary troughs or flumes,and also by providing inlets for surface water to the drains into which the waste water is conducted through movable wooden spouts.

The work on the Huntington field was ardous and discouraging because of the extreme wetness of the soil and its consequent unstable condition. The depth from which the water came into the field and the peculiar hardpan conditions before described made it difficult both to locate and construct drains that would accomplish the desired object. The salts on the surface of the soil being largely sulfates, are easily dissolved and removed, but it is essential that the soil water which passes through the hardpan or shale-like structure be prevented from coming to the surface since it is highly charged with mineral in solution and when evaporated from the surface will afford a constant supply of alkali.

The drainage of this tract leads to some conclusions which concern the entire Castle Valley. It may be observed first that every drain which intercepts and leads soil water to an outlet lessens the difficulty of draining land adjoining it on the lower side of the slope. The land on the north and west of the Geary tract was flooded with water both summer and winter, and having a slope of 15 inches in 100 feet, subjected the drainage tract to a constant underground water pressure. The surface flow could be intercepted by waste ditches, but the underflow only by underdrains. The slope is so great that it is probable that every 40 acres will require one or two drains. If the water were shut off

from all the fields about harvest time so that the ground water would be decreased, it is believed that drains can be made with much less difficulty than was experienced in this experiment. Lumber seems to be the only material available for drains. On account of the fall in the land, 12 inches to 18 inches per hundred feet, and the soft condition of the soil, it will be best to use boxes with bottoms placed outside of the tie pieces, especially in soft ground. Ordinarily field drains may then be made with sides 6 inches wide and top and bottom board 8 inches wide.

The cost of the drain laid was 11 1-5 cents per foot. The trenching cost 2½ cents per foot where the ground was in good condition, but a considerable part of the ditches required curbing and other special treatment requiring unusual labor in placing the drains, which greatly increased the cost. The lumber was hauled 25 miles and cost $18 per thousand feet delivered on the field. It is believed that by taking 80 to 200 acres under one project and shutting off the water supply for a time from the slopes above the area to be drained, the wet lands in this part of the valley can be made dry at a cost not exceeding $10 an acre. An examination of the earth through which the Huntington canal is constructed gives good reason for believing that a large per cent of the water is lost by seepage and adds no small amount to the supply which swamps the cultivated land. Close observation is required to locate the under supply which works the injury to the land. As shown by the experiment described, water may be found in copious quantities 10 feet below the surface, giving a constant supply through the shaley hardpan above, to the surface. wells, at such points, in connection with drains, greatly assist in reducing the supply of water. The attempt to drain the soil without first cutting off the ouside supply, failed in the field under discussion.

The agreement of the Office of Experiment Stations and the State Station with Mr. Geary, gives to the former the right to add to or modify the drains and to keep a record of their action and results for a term of three years from August 1905.

Where the subsoil is in a semi-fluid condition, the method of cutting the ditches with the aid of a stream of water seems to be practicable where the material can be discharged without injury to other land, and in such cases is to be recommended. The concentration of water at various points by the stratified hardpan

makes the drainage of fields here a local problem as far as field treatment is concerned, but several sections have deep washes available into which to discharge drainage water. This is especially true of the town of Huntington, where drainage is a necessity for restoring the lots and gardens to productiveness. Deep drains, though difficult and expensive to make, are absolutely essential to success in drying the land in this valley.

Washington County.

The settlement which was made on the Virgin River in Washington County in 1860 is notable by reason of the daring and enterprise exhibited by the settlers at that time, and the development of that region which has been accomplished under more than usual difficulties. St. George, the principal town of the region, is 65 miles by stage from Modena, the nearest railroad point. The entire valley is noted for its mild climate and the production of fruits and crops indigenous to a semitropical region. As early as 1885 some of the low lands under the old canal were abandoned because of an excess of water and alkali. The expense of rebuilding several dams in Virgin River and the canals for the supplying of the water had brought the cost of the land reclaimed up to $67.50 per acre. The last field brought under irrigation is called Lower Washington Field, which is believed to be an old lake bed and contains approximately one thousand acres. Water is upplied to this field by a canal which encompasses it on three sides. For four or five years after its reclamation enormous crops were grown upon the field. Soon, however, it was found that a portion of the lower land was saturated, and an attempt was made to relieve the situation by a ditch constructed through the lowest ground and leading finally to the river. This, however, had but little effect and the area of injured land, which at first was small, gradually extended until at the time these investigations began fully one-half of the lower Washington Field was abandoned, a part becoming a bog filled with tules and other parts wholly or partially unproductive. A conservative estimate of the annual net value of the crops from these lands when in good condition is $20 to $22 per acre, while for the crops requiring more extensive culture, such as fruit and vegetables, the value is much greater.

A survey of the soil of this area made by Mr. Strahorn of the Bureau of Soils, includes a classification of the soil by types and the location and percentage of alkali found in the different sections of the field. Four types of soil are described differing mainly only in the percentage of very fine sand as determined by mechanical analyses. The content in total salts runs as high as 3 per cent, none being less than 1 per cent. He reports no carbonates, the alkali of the soil being confined to the sulfates, which is regarded as an encouraging feature. The field test of the water used in irrigation shows the presence of about 169 parts of total salts to 100,000 parts of water. Hardpan occurs in a narrow strip next to the canal in the southwestern part of the field. It is a gypsum and sand hardpan which before the application of water was very compact but since the soil has beeen wet it is largely broken and can be handled with a shovel. While hardpan may have been a factor in the concentration of water in this field, it does not now appear to materially effect either the disribution of water or its percolation through that soil which has become wet. The report of Mr. Strahorn shows that varying quantities of salts are found in spots which occur at irregular intervals over the saturated portion of the field.

In October, 1905, an agreement was entered into between five of the owners of adjoining land in Washington Field and the Office of Experiment Stations in conjunction with the State Station by which the former were to perform the work required in carrying out the experimental plan of drainage and the latter to furnish the material upon the ground and supervise the laying out and construction of the drains. The plan adopted, as shown in figure 5, consists of parallel drains laid diagonally with the greatest slope of the land and discharging into a waste ditch which was to be deepened sufficiently to permit the laying of the underdrain to a depth of four feet. In the absence of better material, lumber was to be used for these drains, made like those described in the Huntington experiment except that the boards for the sides were to be six inches wide instead of eight inches. The lumber for this work was hauled from the mountains a distance of 100 miles, and cost delivered upon the field $31.50 per thousand feet. The drain highest on the slope was placed at what was regarded as the upper edge of the saturated belt, the object of this location being to intercept the underground water which percolated from the

land lying between it and the supply ditch on the east. The drains farther down the slope were intended to interecept such water as passed the upper drain and also to afford ample facilities for the removal of such irrigation water as would be applied to the land, especially for the flooding out of the excess of alkali.

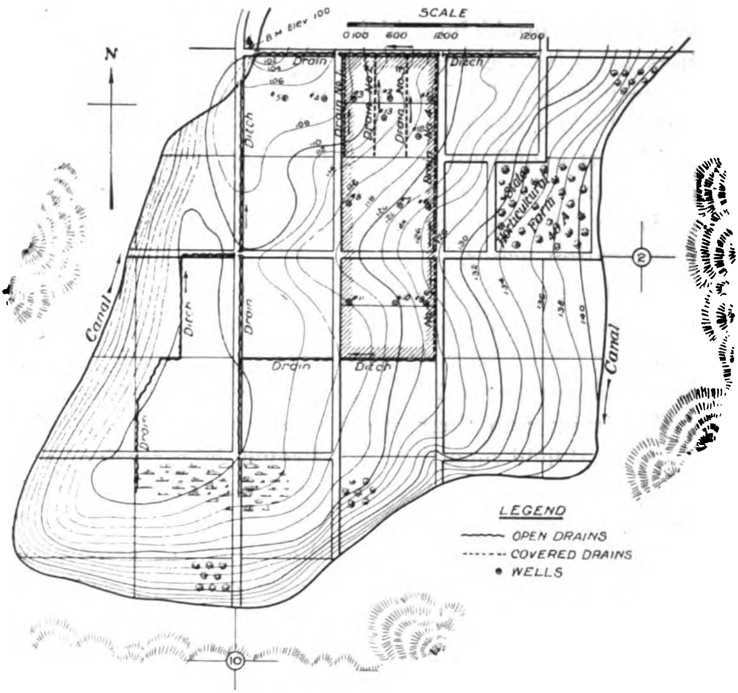


Fig. 5—Topographical Map of Washington Field, Utah.

Only one drain was laid in some portions of the field to ascertain the effect it would have upon the soil on the slope below it. Eleven test wells, as indicated on the map, were made for the purpose of ascertaining by measurement the fluctuations of the water and the effect of the drains upon the water table in the several fields. The drains as laid out were completed in December, 1905. The water level was found, in some instances, at 2 feet from the surface, and considerable difficulty was experienced in digging the ditches and laying the boxes in some sections on account of the semi-fluid condition of the lower soil.

The total number of feet of drain laid was 7,893, the average depth being 4½ feet. The actual average cost for labor in digging

trenches, making the boxes, laying the drains, and filling the ditch was $4.81 per hundred feet, the cost for materials and surveying was $6.40 per hundred feet, making a total $11.21 per hundred feet and $1.85 per rod. The cost of labor is determined by keeping account of the time actually taken by the farmers, who performed the labor themselves and reckoned at $2 a day for 9 hours work. It should be said in this connection that the field is 6 miles from St. George where the farmers live, which fact detracts very materially from the efficiency and value of labor, not only in the construction of drains but in the annual operation of the fields. It is difficult under such conditions to watch fields closely and attend to those details of cultivation and irrigation so essential to a high degree of success, especially in the management of irrigation water.

The work was laid out and supervised by Mr. Brown. Mr. McArthur, one of the owners of the drained fields, measured and recorded the position of the water table in the test wells during the winter and summer of 1906. The following account of the action of the drains and their effect upon the fields is condensed from the several field reports of Mr. Brown, who received weekly reports and also inspected the area operated upon at two different times during the season.

The weekly measurements of the depths of ground water showed that during the winter the drains operated well and the ground water remained low. As soon as spring irrigation began much trouble was experienced in preventing the surface water from entering the drains in large streams which washed the fine soil into them, causing obstructions. The earth contains considerable fine sand with little clay, which when wet melted away easily and passed into the drains and in some instances clogged them. No special caution was taken in the filling of the trenches to compact the earth in such a way as to obviate this injury. In fact, the nature of the soil is such that more than ordinary precautions are necessary to compact newly moved earth so that it will be as solid as that in place. The drains were opened at times and the obstruction removed. Check gates were also placed at various points in the drains so that they could be closed when irrigation water was applied and afterwards opened for drainage purposes. This plan is practiced successfully in some other localities where like difficulties are experienced in irrigating underdrained

land. These precautions did not, however, fully accomplish the object, although it is believed that much of the injury found was done previous to the placing of the gates.

It should be observed in this connection that the drains were laid upon different grades, the lower part of each drain being upon a grade of 0.1 to 0.3 per hundred feet, while the head end of the drains had a grade of one foot per hundred feet. The sandy soil which gathered in the upper portion, lodged in the portion with flat grades, occasioning obstructions at those points. For this reason a part of some of the drains became inoperative and the water level in the soil on a portion of the tract remained too high.

It appeared also that the drains in some places were not deep enough to intercept all of the underflow. Twenty acres of the land which was in alfalfa, responded to the drains by an improved yield in the crop. An attempt was made to grow sorghum upon a tract which had been abandoned, without special treatment of the soil for the removal of alkali, but the growth of the plants was spotted and on the whole was not satisfactory. It would seem that the main difficulty in this experiment was first in maintaining the drains, the second in their lack of sufficient depth in some places at least, to intercept the water. The experience here shows that drains in soils of this character should have a grade of at least 0.3 foot per hundred and that a grade of more than 0.6 is undesirable. The first is required for the removal of such silt as unavoildably reaches the drain, and the second limitation is required because of the erosion of the bottom of the drain when full of water. To bring the grade of the drains within these limits it would be necessary to locate them more nearly on contour lines, thus making them less regular and more uniform in their distance apart·

It is also essential that during the first season after the construction of the drains, as has been mentioned in the report of the Huntington work, that little irrigation water should be allowed to run over the filled trenches. It is suggested that a furrow be run to each side of the trench as near to it as practicable, for the purpose of cutting off any irrigation water used on the tract between the drains, and that provision for waste water to enter the drains be made at intervals where it may be conducted from these furrows by means of wooden troughs or spouts. At such places

a vertical box 6 by 6 inches may be placed, reaching from the surface to the drain, at which point a bottom board should be placed to prevent the erosion of the bottom of the drain by the water which flows into it from the surface. At times when convenient water might be admitted to the trenches for the purpose of settling the earth, which atfer the first season would probably give but little trouble, such as has been mentioned. More precautions should also be taken in the filling of the ditch at the time of the completion of the drain.

The following additional work is planned for this experiment: First, it is proposed to make surface openings to the drains such as have been described, at points where there appeared to be obstructions, and at suitable times to permit a stream of clear water to enter with a view of removing the obstructions in the drains where the minimum grade has been used.

Second, to construct an additional drain as shown upon the plat, in the line of greatest slope and in a section of the field in which water appears to concentrate, the same to be placed deeper than any of those so far used. It is proposed to co-operate with the owners of the land in the construction of this drain, upon the same terms as governed the works of 1905. The expense to be borne by the Department and State for material is estimated at $300, and arrangements are being perfected at this date (November) to construct the drain during the winter. As yet no special treatment for the relief of the soil from alkali has been undertaken. It is believed that the proposed drain together with those already installed will indicate the plan that may be profitably followed to make the land dry, after which special attention should be given to the complete reclamation of the injured soil. If these drains can be properly located and placed sufficiently deep, but few will be needed.

It will also be important to have a few drains upon the lower side of the slope in each case into which surface irrigation water can be conducted, thus lowering the level of the waste water and obviating the injury it does when discharged into a shallow waste ditch.

It seems quite clear also that more care is required in the application of water to fields which have underdrains than to those which have none. This is usually found true elsewhere in locations where the soil is of an ash nature or exceedingly fine and de-

void of the clay element. It will necessitate more labor upon the given area of land and a correspondingly better return from the land. The fertility of the soil and the profits which it may be made to yield when under favorable conditions, will justify the care and labor which this contingency in the management of irrigated lands has forced upon its owners.

Operations in 1906.

An examination of the land irrigated by the Bear River canals in Box Elder County shows that much of the land valuable for the growing of sugar beets has been abandoned to salt grass and fox tail, while much of that which is being cropped shows injury, which has increased noticeably during the last two years. In the soil report of Jenson and Strahorn, of the Bureau of Soils (1904), it is stated that the only areas which are entirely free from alkali are in the northern end of the valley from Tremont to Fielding, and along the mountain slope on the east side. It is significant to note that alkali and water-logging have developed since that survey was made to such an extent that between Garland and Riverside, the center of the free district, is an area which now shows water-logging and consequent alkali conditions. It is here that arragements were made with eleven land owners to co-operate in the construction of a system of tile drainage for preventing further injury to that most productive section. The land is within two miles of the town of Garland, which is the center of the sugar beet area of that county. The conditions found here were some what different from those in the experiments before noted. No part of the land was entirely unproductive and the alkali had not accumulated to an injurious extent. The ground was so filled with water that planting in the spring was greatly delayed and the rains which followed destroyed the crop in the portions of the fields where light natural depressions existed. On this account drainage is needed not only to lower the ground water which accumulates from irrigation but to remove the rain water which falls in large quantities during some spring seasons.

A plan of drainage was made by Mr. Brown directly affecting an area of 200 acres but indirectly benefitting four or five hundred acres. The plan specified the use of drain tile aggregating 6.300 feet, varying in size from 5 inches in diameter to 10 in-

ches in diameter, the estimated cost of which was $610.32, of which $190.55 was to be contributed from the State and Federal fund, the farmers concerned to bear the balance of the expense including the labor of digging the trenches and placing the drains. The entire expense was estimated at $820.32; this with the exception of the amount contributed from the State and Federal fund, was divided among the eleven land owners in proportion to the acreage owned by each and the degree of benefit conferred upon the land by the work. It should be said that one of the most expensive parts of this drain was the outlet, which was constructed along the highway for a distance of 2,240 feet, in which 8-inch and 10-inch tile were used. This work was begun in June but proceeded slowly on account of the scarcity of labor which in the fall was so great that for a time no work was done. At this date work has been resumed with indications that the drains will be completed before winter sets in. While the field system has not yet been completed, it is reported that the land is much dryer than for the last two years, indicating that the drains though

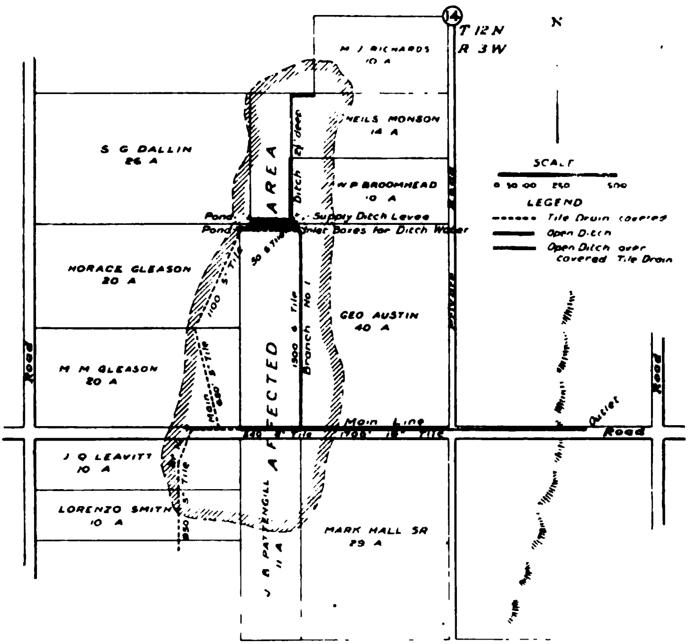


Fig. 6—Map of Garland Drainage Experiment.

only partially constructed have aided materilly in decreasing the quantity of water usually found in the soil.

The land of this valley is suitable for the use of drain tile and its nearness to the cities of Ogden and Salt Lake, where factories are located, makes them available at a reasonable cost. The surface soil is firm and not easily eroded and the subsoil is firm clay but of such a nature that it permits the quite ready percolation of water through it, making the conditions of the entire valley very favorable for the use of drain tile. This project was planned and carried out through the cooperation of the landowners without organizing the territory into a drainage district as provided for by the State drainage law. It may be noted that it is impossible to apply the law to such small areas as the names of fifty landowners are required upon a petition for the organization of a district before the matter can be brought under the jurisdiction of the county commissioners. The plan (Fig. 6) shows the plan of the drains and the ownership of the land, together with other data pertaining to the work.

Another experiment in the Bear River Valley will be made upon the farm of Louis Getz at Point Lookout, in which tile drains will be laid by the owner of the land, the cost of the tile delivered at the nearest railway station to be paid for from the joint State and Federal fund. A plat of this work is shown in Figure 7. The drains will effect 40 acres of land, a considerable portion of which has become too wet for production and upon which also the accumulation of alkali intensified the injury. This field is fairly typical of a large area lying in the southern part of the valley which is now only partially productive on account of the excess of both alkali and water. The drain tile for this work have been purchased at a cost of $330.76, the largest being 8 inches and the smallest 4 inches in diameter. The minimum grade is 0.1 foot per hundred feet and the maximum 0.3 foot per hundred feet. The depth of the drains varies between the limits of 4 feet 7 inches and 3 feet 4 inches. The soil in this valley being much heavier than that in the Huntington and St. George districts, can be drained at much less expense and with less attending risk of injury of the drains by subsequent irrigation. As will be noticed by referring to the plan, the drains are located with special reference to the portions of the field which show most injury. The object of this experiment is to determine the effect

of drains located in this way, upon land which is injured by both alkali and water, and the owner by subsequent cultivation or flooding may ascertain what kind of additional treatment will be required to restore the soil to productiveness. It is stated by

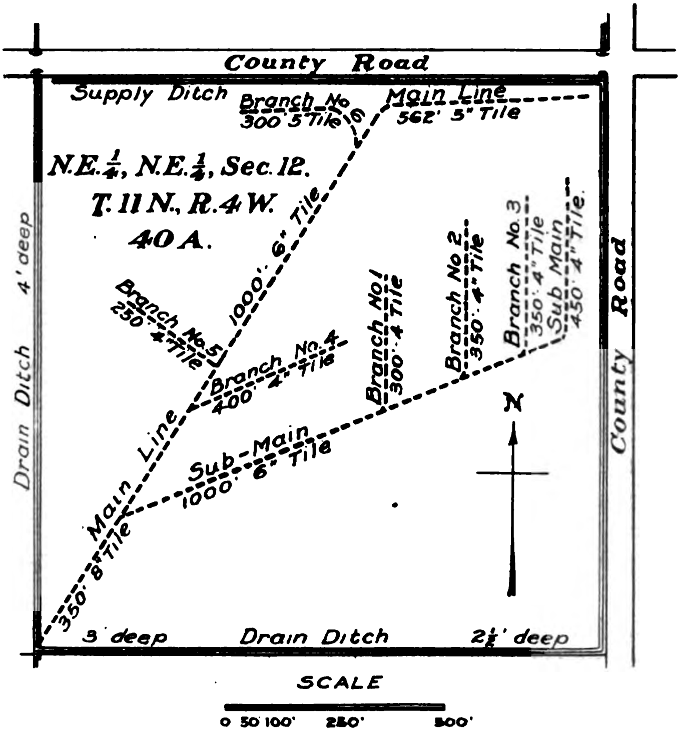


Fig. 7—Map of Getz Farm Showing Experiment Drains.

the Bureau of Soils that no black alkali (sodium carbonate) is found in this land, the salts being mainly common salt and the sulfates.

The cooperative agreements are entered into with farmers who are well known and have a reputation of being substantial and thrifty farmers and who in all cases agree to take care of the drains and cultivate their lands in the best possible manner, and improve every means suggested in the removal of alkali where such salts are found.

Measures are being taken by the landowners in the vicinity of Point Lookout to organize a drainage district under the laws

of the State. The general level character of the county necessitates the construction of general outlet ditches before many farms now showing injury can be drained. The district is called the Rawlins Drainage District, and comprises all that land west of Salt Creek and under the West Side Canal in Box Elder County, aggregating 8,000 acres. This is the first attempt in the State to organize under the present drainage law. Mr. Brown, upon request, has made the preliminary surveys and will during the winter submit plans for the ditches required. In attempting to organize this district it is found that the law is faulty in many respects and an attempt will be made to so amend it at the session of the coming legislature that it will be adequate to the needs of the owners of areas where cooperative drainage is required. Such defects as have been brought out in effecting this organization have been recorded, and information collected regarding the laws used in other States, for the purpose of materially assisting those who will have charge of introducing an amendment to the law in the legislature.

WEBER COUNTY.

The land in the vicinity of Roy, Weber County, when examined, was found to need drainage, there being several farms in which tule swamps are found and fields which have but recently ceased to produce well because of seepage and alkali. The surface of the land lies in a series of narrow benches having a difference of elevation of between 6 feet and 10 feet. Seepage water appears at the foot of the benches, gradually extends down the slope, bringing an accumulation of alkali sufficient to prevent the growth of field crops and trees. Efforts have been made by a few of the farmers to arrest the encroachments of the alkali spots but they have failed, or at the best have been only partially successful. The soil in most places is underlaid by a stratum of sand which is favorable for the carrying of water into the lower levels. Arrangements have been made with Mr. J. H. Hobson, owning land about two miles from Roy, a station on the Oregon Short Line Railroad, to drain a field a portion of which is planted to young fruit trees. Figure 8 shows the proposed arrangement of tile drains which will effect approximately 40 acres. It is planned to lay the tile in the upper part of

the sand stratum which underlies the soil, for the purpose of utilizing the sand layer in completing the drainage. To obviate difficulties which may arise from the soft nature of the sand. it is planned to lay the tiles upon a board 6 inches wide and 1 inch thick which is to be placed in the bottom of the trench after it has been well graded. As in other experiments, the owner agrees

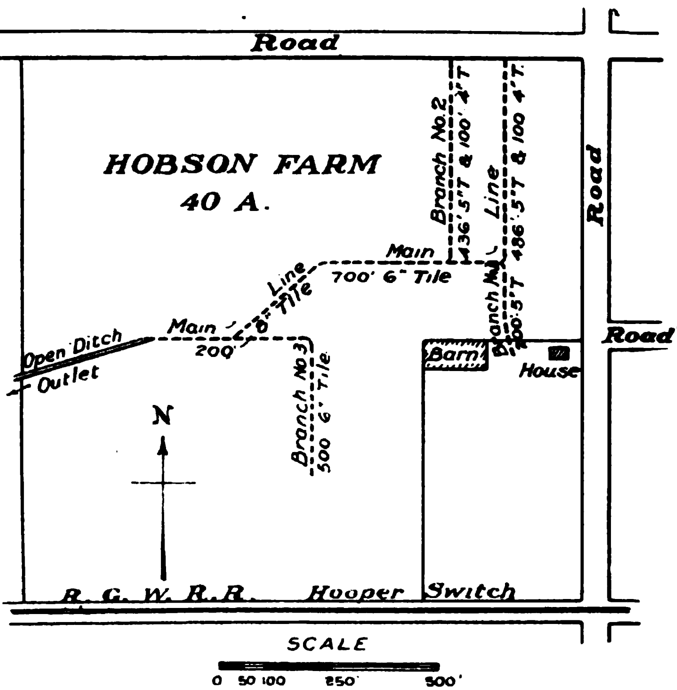


Fig. 8—Map of Hobson Far mShowing Experiment Drains.

to perform all of the labor connected with the construction of the drains in accordance with the plans made by Mr. Brown and under his supervision, the tile to be furnished from the State and Federal fund, the cost of which is estimated at $100. As in other cases, the owner agrees to subsequently cultivate all land in a workmanlike manner and to permit observations and further experiments if desired by the State and Federal service. This work will probably be completed before winter so that during the coming season results may be obtained and reported. The land in this vicinity is valued at $150 per acre when in good condition.

As elsewhere, there is a lack of adequate outlet ditches which must be constructed before any extended system of drainage can be undertaken.

SEVIER COUNTY.

An examination of the lands in Sevier County shows that in no other county of the State is the subject of drainage more important. It is estimated that from 25 to 50 per cent of the land under irrigation is greatly injured or has been abandoned, suggesting that prompt measures should be taken for the reclamation of these lands. Owing to the gravity of the situation, arrangements have been completed and plans made for the installation of drainage work on the farms of William Ogden and William Gardener near Richfield. The plans call for 7,000 feet of drain tile, which will cost $562. The land-owners agree as in other cases to perform all of the work required in making the drains. It is found that the farmers are more willing to contribute the labor required than the tile, for which a direct cash outlay is required, and the Department can furnish the latter much more satisfactory than the former. This drainage work will be begun the present fall but cannot be completed until next spring.

During the two years in which drainage operations have been carried on in this State under the provision of the act of the legislature appropriationg money for that purpose, experimental work has been done in six counties, in all cases in cooperation with the owners of land upon which work was performed and with an agreement giving the State Station and the Department control of the drains for three years following construction. Such methods of drainage have been used as seemed to promise results of practical value and which, if found successful, would be within the means of the farmers in the several localities. The fact is recognized that the work is experimental as far as the particular locality is concerned. The difficulties encountered and the details and minutia of operations are not fully set forth in this report. Each field experiment has a more particular value to the locality contiguous to it than to any other. As may be inferred from the conditions described in this report, the methods

used in Cache County will not apply to or be of particular interest to farmers in Washington County.

Mr. C. F. Brown, drainage engineer of the office of Experiment Stations, to whom the field management has been entrusted, has in addition to planning and supervising the field work herein described, made surveys for and given advice to farmers upon their application, as far as his time would permit, upon drainage work which they are desirous of doing upon their own account. The revision of the State law is now engaging the attention of a few of the land owners who are finding cooperation necessary to secure and maintain drainage outlets. The entire development of the country has heretofore been made with reference to the needs and practice of irrigation, upon the theory that no provision for removing drainage water need be made. Continuous plains are more favorable for irrigating than a surface broken by depressions which may be used for drainage purposes. When drainage is found necessary the main channels required for outlets are usually wanting or so far distant from the land to be drained that additional ditches must be made by artificial methods. Such work requires the cooperation of the landowners to be benefited and a distribution of the expense, which cannot satisfactorily be made except under the regulations imposed by a State drainage law.

Some amendments to the law, approved March 17, 1905, are here suggested with a view of making it more effective and better adapted to the needs of those who find it necessary to construct cooperative drainage works.

1. The petition presented to the board of county commissioners should describe the territory for which drainage is desired, the character of the work required, and should be signed by the owners of the major part of the land instead of by 50, as the law now requires.

2. The county board should have authority to dismiss the petition at the cost of the signers of the petition, or establish the district without causing a vote to be taken by the property holders. When declared established, the commissioners should have power to order an election for choosing three directors who shall subsequently administer the affairs of the district.

3. The board of directors should cause a plan of drainage to be prepared with an estimate of the cost of the proposed work, which before being adopted by the board, should be submitted to the State Engineer for approval or revision, which when finally adopted shall be carried out by the board of directors.

4. Assessments to provide funds for the prosecution of the work shall be made by the board of directors, as a special assessment, based upon the benefit which will accrue to each landowner within the district, as specified in the present law.

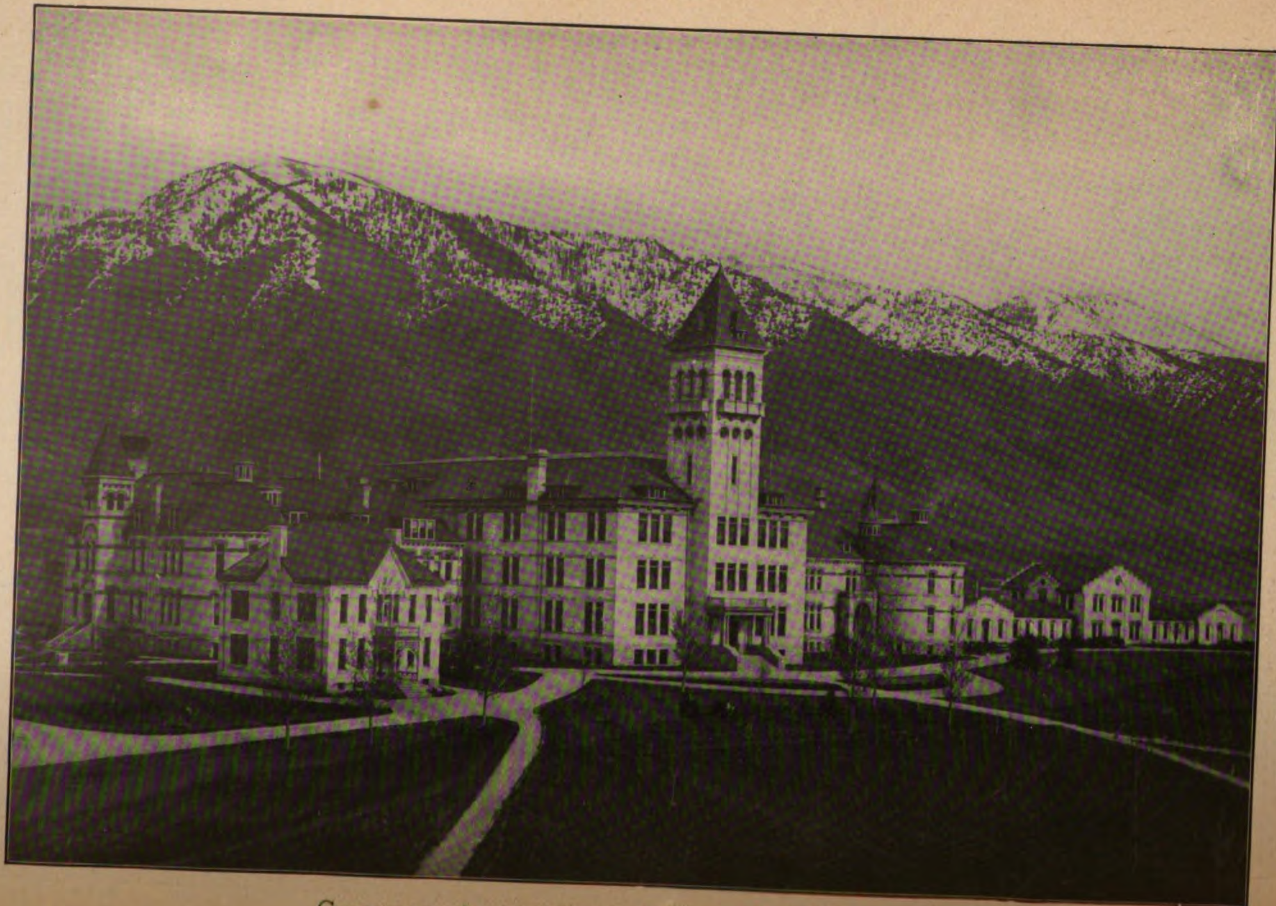
It is thought that if the above suggestions are incorporated in amendments to the present law, it will enable landowners to form districts of any desired size and prosecute the work economically and efficiently, provided of course that the law in its present form is constitutional.

Conclusions regarding the experimental drainage work, especially that of 1906, can not be drawn at the writing of this report. Some of the construction work started will not be completed until the coming spring nor will the results of any of the work of 1906 appear until the following season. The inauguration of these experiments upon the farms in so many different representative parts of the State where drainage is needed has already encouraged farmers to begin operations on their own account. It seems clear that this problem must be attacked in a more energetic manner than has heretofore been thought necessary. Means must be devised for opening and maintaining outlet ditches to wet lands, which will entail a certain expense and inconvenience in the management of farms. The installation of drains will also require a modification in the methods of farming in some respects, especially in the application of water.

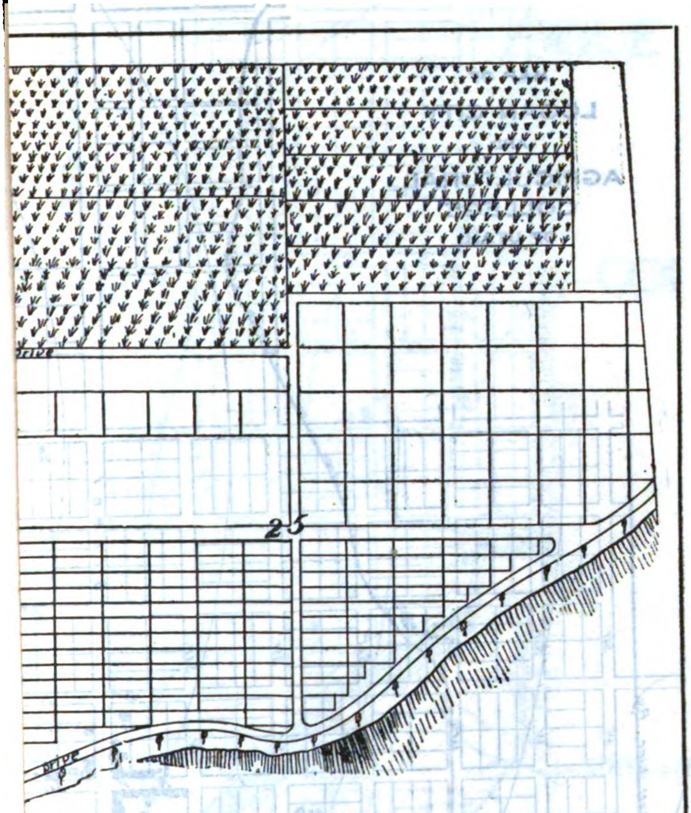
It is recommended that the experiments so far made be made the subject of a future report in which the practical results may be fully described and become available to the farmers of the State, and that provision be made for conducting similar work in other sections of the same counties and in other counties of the State.

ACKNOWLEDGMENTS

We take pleasure in acknowledging our indebtedness to the persons and organizations who have contributed to the success of this work by their aid and cooperation—to the farmers who participated in the irrigation and the drainage experiments; to the people generally in the communities in which these investigations were carried out for their interest and spirit of helpfulness; and especially also to the railroad companies for their aid in furnishing transportation to those in charge of the work, enabling them to keep in closer touch with the work and in making it more extensive than would have been possible without this cooperation.

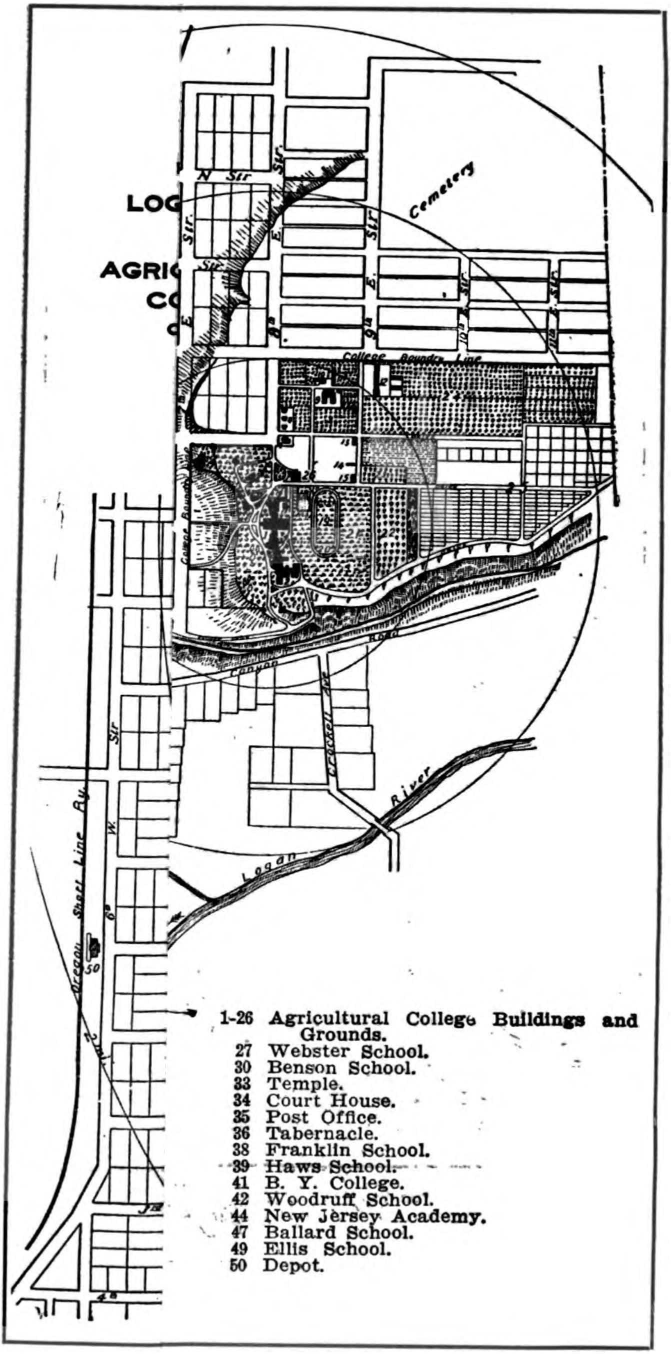


Group of Agricultural College Buildings.



PLAN OF COLLEGE CAMPUS.

1 Main College Building.
2 Mechanic Arts Building
3 Experiment Station.
4 Dormitory.
5 President's Residence.
6 Director's Residence.
7 Farm Superintendent's Res.
8 Farm Cottages.
9 Cattle Barn.
10 Sheep Barn.
11 Piggery.
12 Poultry Buildings.
13 Vegetation House.
14 Tie Sheds.
15 Veterinary Hospital.
16 Conservatory.
17 Boiler House.
18 Tennis Court.
19 Foot Ball Field.
20 Track.
21 Athletic Field.
22 Experiment Orchard.
23 Model Orchard.
24 Pastures.
25 Experiment Plats.
26 Horse Barn.



1-26 Agricultural College Buildings and Grounds.
27 Webster School.
30 Benson School.
33 Temple.
34 Court House.
35 Post Office.
36 Tabernacle.
38 Franklin School.
39 Haws School.
41 B. Y. College.
42 Woodruff School.
44 New Jersey Academy.
47 Ballard School.
49 Ellis School.
50 Depot.

CATALOGUE

OF THE

AGRICULTURAL COLLEGE

OF UTAH

FOR

1906-1907

With List of Students for 1905-1906

LOGAN, UTAH

Published by the College
July, 1906

1906.

JANUARY

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COLLEGE CALENDAR, 1906-1907.

FIRST TERM.

1906.

September 18, Tuesday:	Entrance examinations. Registration of former students, and of new students who are admitted on certificates.
September 19, Wednesday:	Instruction begins.
November 28, Wednesday:	Thanksgiving recess begins:
Decemmber 4, Tuesday:	Instruction resumed.
December 21, Friday: (at noon)	Holiday recess begins.

1907.

January 8, Tuesday:	Instruction resumed. Winter courses begin.
January 26, Saturday:	First term ends. Winter course in Agriculture ends.

SECOND TERM.

January 29, Tuesday:	Second term begins.
February 22, Friday:	Washington's birthday.
March 30, Saturday:	Winter courses in Domestic Arts and in Mechanic Arts end.
April ——, ————:	Arbor Day.
June 2, Sunday:	Baccalaureate sermon.
June 3, Monday:	Class day.
June 4, Tuesday:	Commencement. Alumni Reunion.
June 5, Wednesday:	Summer vacation begins.

Officers of Administration and Instruction

THE COLLEGE FACULTY.

(*Arranged in Groups in the Order of Seniority of Appointment.*)

WILLIAM JASPER KERR, D. Sc.,

PRESIDENT.

DALINDA COTEY, B. S.,

Professor of Domestic Science.

JOSEPH JENSON, S. B.,

DIRECTOR OF MANUAL TRAINING IN MECHANIC ARTS.

Professor of Mechanical Engineering.

WILLARD SAMUEL LANGTON, B. S.,

Professor of Mathematics and Astronomy.

ALFRED HORATIO UPHAM, A. M.,

Professor of English Language and Literature.

ELMER DARWIN BALL, M. Sc.,*

Professor of Zoology and Entomology.

ROBERT WALLACE CLARK, B. Agr.,**

Professor of Animal Industry.

EDWARD WILLIAM ROBINSON,

Professor of Political Science and Transportation.

---

*On leave of absence. October 1, 1906.

**Withdraws from the College September 1, 1906.

JOHN ANDREW BEXELL, A. M.,
SECRETARY BOARD OF TRUSTEES.
Professor of Commerce.

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Professor of Music.

ROBERT STARR NORTHROP, B. S.,
Professor of Horticulture and Botany.

PETER A. YODER, M. A., Ph. D.,
DIRECTOR OF EXPERIMENT STATION.
Professor of Chemistry.

GEORGE THOMAS, A. B., Ph. D.,
Professor of History and Economics.

WILLIAM PETERSON, B. S.,
Professor of Geology and Physics.

WILLIAM JARDINE, B. S.,
Professor of Agronomy.

WALTER WESLEY McLAUGHLIN, B. S.,
Professor of Irrigation and Drainage.

HYRUM JOHN FREDERICK, D. V. M.,
Professor of Veterinary Science.

JAMES DRYDEN,
Professor of Animal Industry.

CHRISTIAN LARSON, M. S. A.,
Professor of Dairying.

GEORGE PETER CAMPBELL, B. S.,
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FRANK RUSSELL ARNOLD, A. M.,
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Professor of Military Science and Tactics

LEANDER A. OSTIEN, M. A.,
Assistant Professor of Mathematics.

RHODA BOWEN COOK,
Assistant Professor of Domestic Arts.

HENRY JEROME STUTTERD,*
Assistant Professor of Drawing.

M. ELIZABETH WYANT, Ph. B.,
Assistant Professor of English Language and Literature.

ROBERT STEWART, B. S.,
Assistant Professor of Chemistry.

JOHN THOMAS CAINE, III., M.S.A.,
Assistant Professor of Animal Husbandry.

ELMER GEORGE PETERSON, B. S.,
Assistant Professor of Zoology and Entomology.

JOHN THOMAS CAINE, JR., B. S.,
REGISTRAR.
Instructor in English.

*On leave of absence.

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Librarian.

RUTH EVELYN MOENCH,
Instructor in English and Physical Culture.

AUGUST J. HANSEN,
Foreman in Carpentry.

EDWARD PARLEY PULLEY, B. S.,
Instructor in Mechanical Engineering.

EDWIN AUGUSTUS WILLIAMS,
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Instructor in English.

WILLIAM ARTHUR JENSEN,
Instructor in Stenography and Typewriting.

DAVID EDMUND STEPHENS, B. S.,
Secretary to the President.

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Instructor in Civil Engineering.

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Instructor in Domestic Science.

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Instructor in English.

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Instructor in Chemistry.

NETTIE THATCHER SLOAN,
Instructor in Music.

WILLIAM FOGELBERG,
Instructor in Music.

JOSEPH A. SMITH, JR.,
Instructor in Music.

LOUIE EUGENIE LINNARTZ,
Instructor in Music.

ROY RUDOLPH, B. S.,
Instructor in Zoology.

JULIE WINGE OSTIEN, B. S.,
Instructor in History.

GERTRUDE VIBRANS,
Instructor in Sewing.

JONATHAN SOCKWELL POWELL,
Instructor in Drawing.

FREDERICK CHRISTIAN WANGSGARD,
Assistant in Forging.

INEZ POWELL,
Assistant in Household Science.

FRANK THATCHER,
Assistant in Carpentry.

JEDEDIAH H. GOFF,
Assistant in Forging.

AARON NEWEY,

Assistant in Carpentry.

EFFIE SMITH,

Assistant in Household Science.

NORA EGBERT,

Assistant in Sewing.

FRED RUSSEL JENSON,

Assistant in Commerce.

JOSEPH SPRAGUE BELL,

Assistant in Commerce.

CHARLES BATT,

Superintendent of Steam Heating and Water Works.

RASMUS OLUF LARSEN,

Head Janitor.

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THE REGISTRAR, *Secretary.*
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PROFESSOR JOSEPH JENSON.
PROFESSOR WILLARD SAMUEL LANGTON.
PROFESSOR ALFRED HORATIO UPHAM.
PROFESSOR ELMER DARWIN BALL.
PROFESSOR ROBERT WALLACE CLARK.
PROFESSOR EDWARD WILLIAM ROBINSON.
PROFESSOR JOHN ANDREW BEXELL.
PROFESSOR GEORGE WASHINGTON THATCHER.
PROFESSOR ROBERT STARR NORTHROP.
PROFESSOR PETER A. YODER.
PROFESSOR GEORGE THOMAS.
PROFESSOR WILLIAM PETERSON.
PROFESSOR WILLIAM JARDINE.
PROFESSOR WALTER W. McLAUGHLIN.
PROFESSOR HYRUM JOHN FREDERICK.
PROFESSOR JAMES DRYDEN.
PROFESSOR CHRISTIAN LARSON.
PROFESSOR GEORGE PETER CAMPBELL.
PROFESSOR FRANK RUSSELL ARNOLD.
HOWARD R. PERRY, CAPT. U. S. A.
ASSISTANT PROFESSOR LEANDER A. OSTIEN.
ASSISTANT PROFESSOR RHODA BOWEN COOK.
ASSISTANT PROFESSOR M. ELIZABETH WYANT.
ASSISTANT PROFESSOR HENRY JEROME STUTTERD.
ASSISTANT PROFESSOR ROBERT STEWART.
ASSISTANT PROFESSOR ELMER GEORGE PETERSON.
ASSISTANT PROFESSOR JOHN T. CAINE, III.

EXPERIMENT STATION STAFF.

PETER A. YODER,
Director and Chemist.

JAMES DRYDEN,
Poultryman.

ELMER DARWIN BALL,
Entomologist.

ROBERT WALLACE CLARK,
Animal Industry.

WALTER WESLEY McLAUGHLIN,
Irrigation Engineer.

ROBERT STARR NORTHROP,
Horticulturist.

HYRUM JOHN FREDERICK,
Veterinarian.

WILLIAM JARDINE,
Agronomist.

JOHN T. CAINE, III.
Animal Industry.

CHRISTIAN LARSON,
Dairyman.

ROBERT STEWART,
Assistant Chemist.

JOSEPH EAMES GREAVES,
Assistant Chemist.

ELMER GEORGE PETERSON,
Assistant Entomologist.

CHARLES WALTER PORTER,
Photographer.

JOHN STEPHENS,
Assistant Agronomist.

HENRY WALACE CROCKET,
Assistant Horticulturist.

GEORGE MELVIN TURPIN,
Assistant Chemist.

WILLARD CONRAD SNOW,
Assistant Chemist.

JOHN ANDREW BEXELL,
Secretary.

JOHN LATHAM COBURN,
Assistant Secretary.

FOREMEN.

JOSEPH BENSON,
Agronomy.

ANSON PERRY WINSOR,
Poultry.

Animal Industry.

JOSEPH T. ATKIN,
Southern Utah Experiment Station.

OLA LARSON,
Central Utah Experiment Station.

STANDING COMMITTEES.

1906-1907.

The President of the College is *ex-officio* a member of all standing committees.

1. *Agriculture.*—Professors Ball, Jardine, Northrop, Larson.

2. *Domestic Science.*—Professors Cotey, Cook.

3. *Commerce.*—Professors Bexell, Robinson, Thomas.

4. *Engineering and Mechanic Arts.*—Professors Jenson, Langton, Mr. N. M. Hansen.

5. *General Science.*—Professors Thomas, Upham, Northrop, Mr. Porter.

6. *Scholarship and Graduation.*—Professors William Peterson, Ostien, Arnold.

7. *Farmers' Institutes.*—Professors Yoder, Cotey, Jenson, McLaughlin, Dryden.

8. *College Publications.*—Professors Upham, Dryden, Wyant, E. G. Peterson, Mr. Jardine.

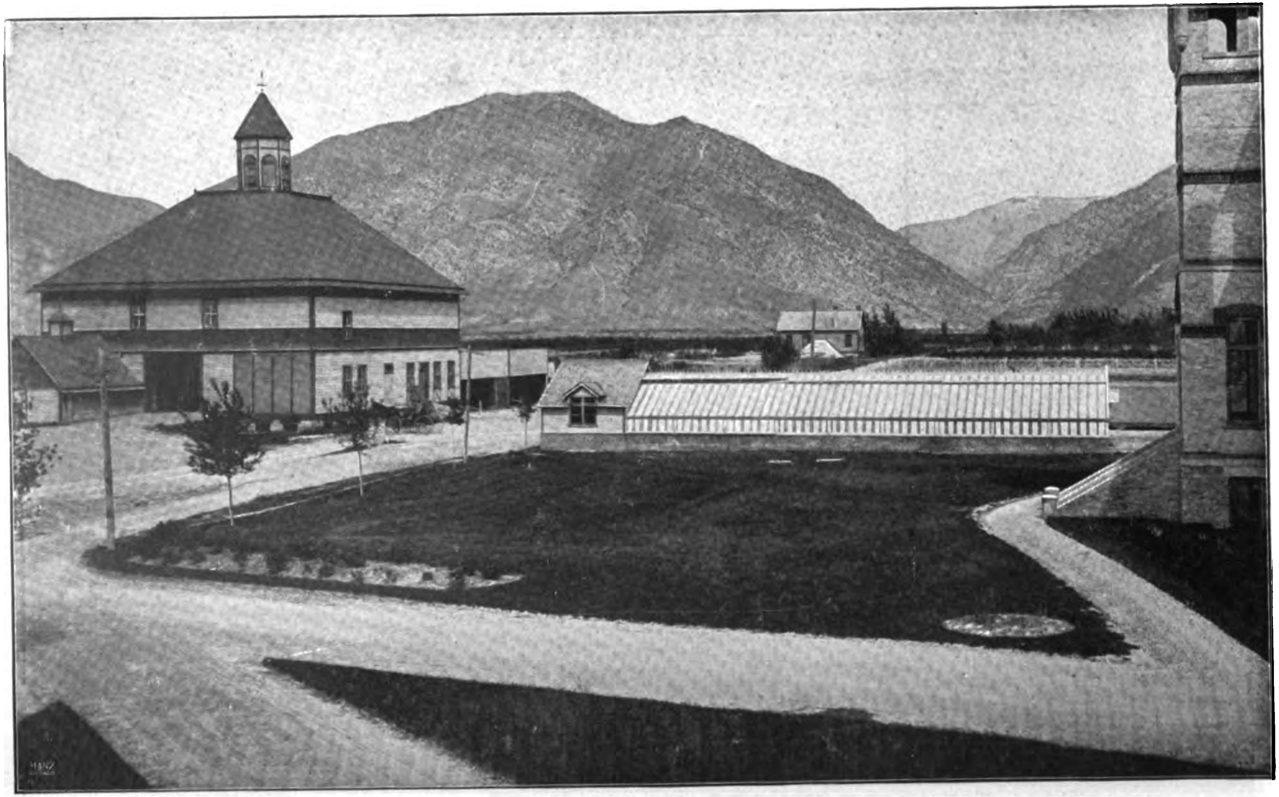
9. *Amusements and Public Entertainments.*—Professors Robinson, Thatcher, Stutterd.

10. *Students' Affairs.*—Professor Ostien, Mr. Caine, Miss Holmgren.

11. *Attendance.*—Professors Caine, Thomas, E. G. Peterson.

12. *Athletics.*—Professors Langton, Campbell, Jenson, Upham, W. Peterson.

SECTION OF CAMPUS AND BUILDINGS.



Horse Barn, Conservatory, Veterinary Hospital.

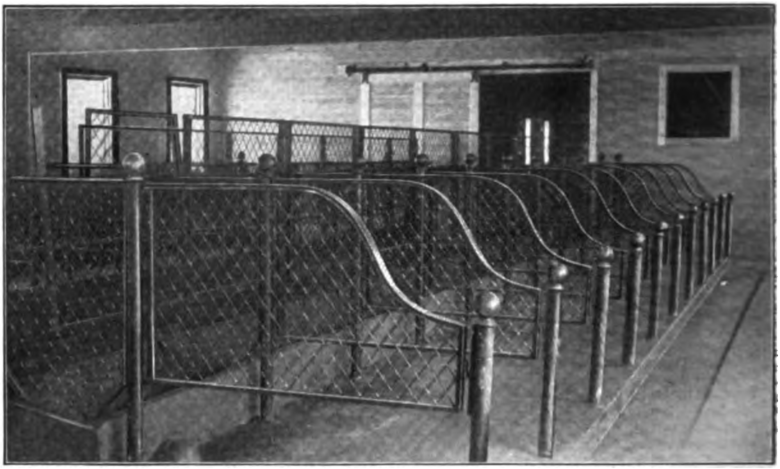
EXPERIMENT STATION BUILDING.

College Sheep Barn and Cattle Barn, from North-East.

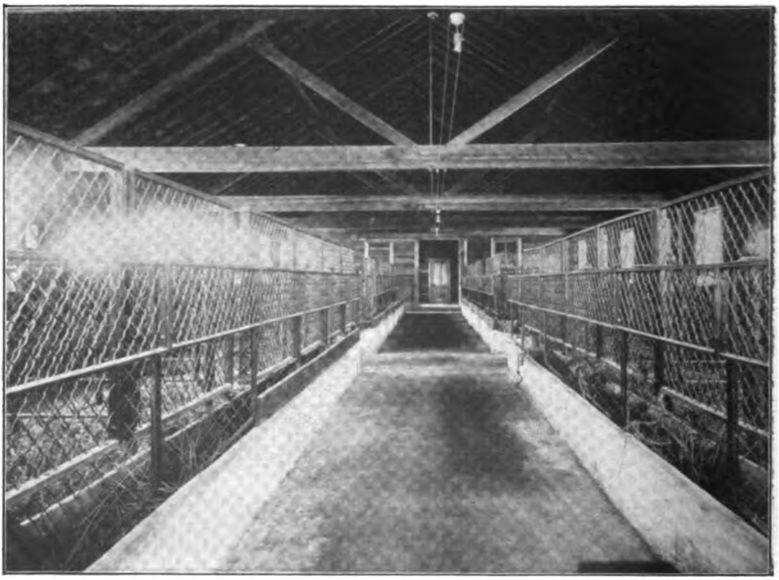
Sheep Barn and Cattle Barn, from South-West.

Poultry Buildings.

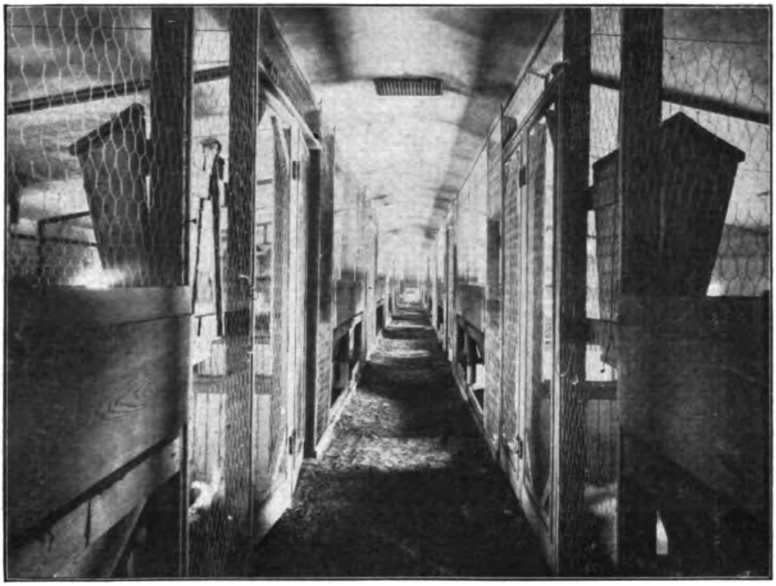
Rear View of Poultry Building Before Completion of Yards.



Stalls in Cattle Barn.



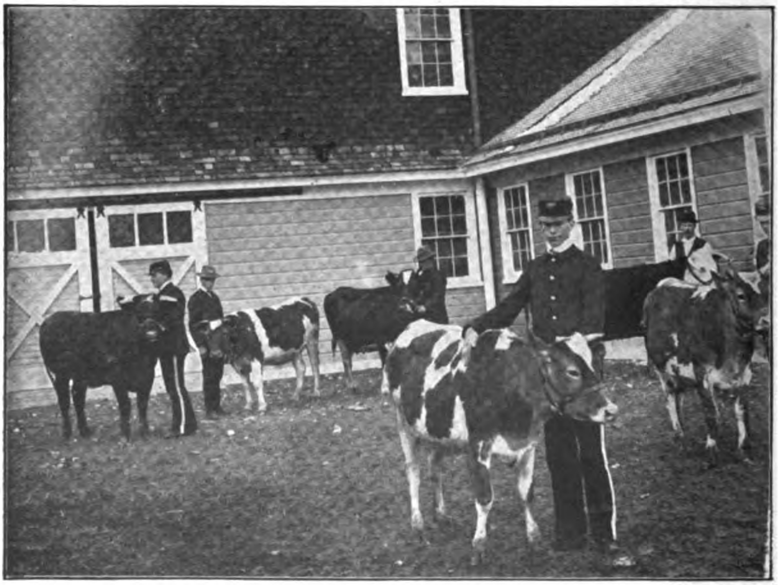
Interior View—Cattle Barn.



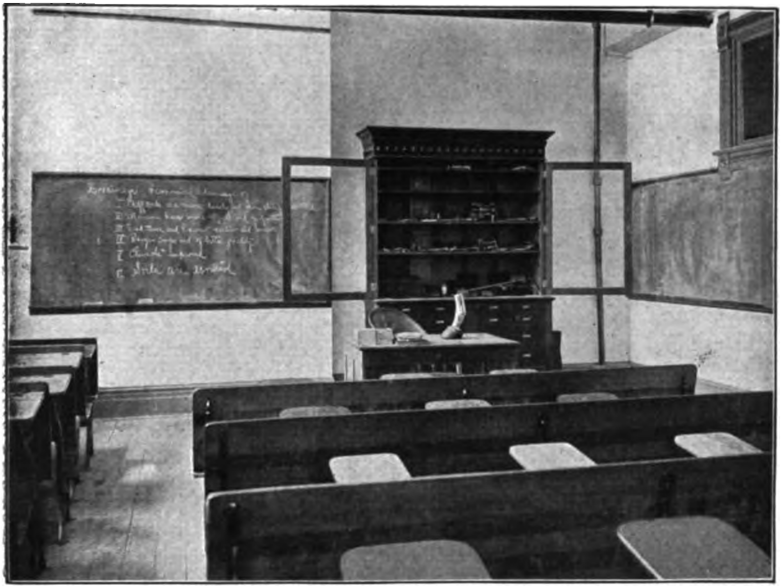
INTERIOR VIEW—POULTRY BUILDING.

PIGGERY.

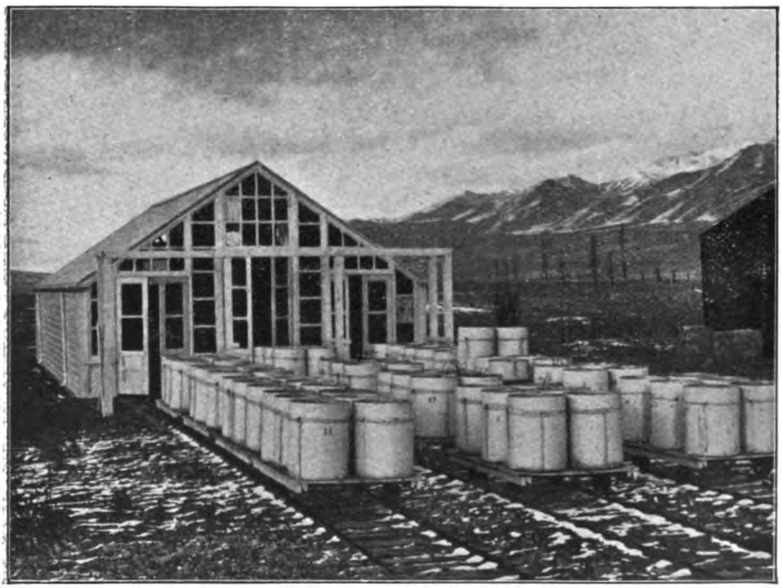
Class in Stock-Judging.



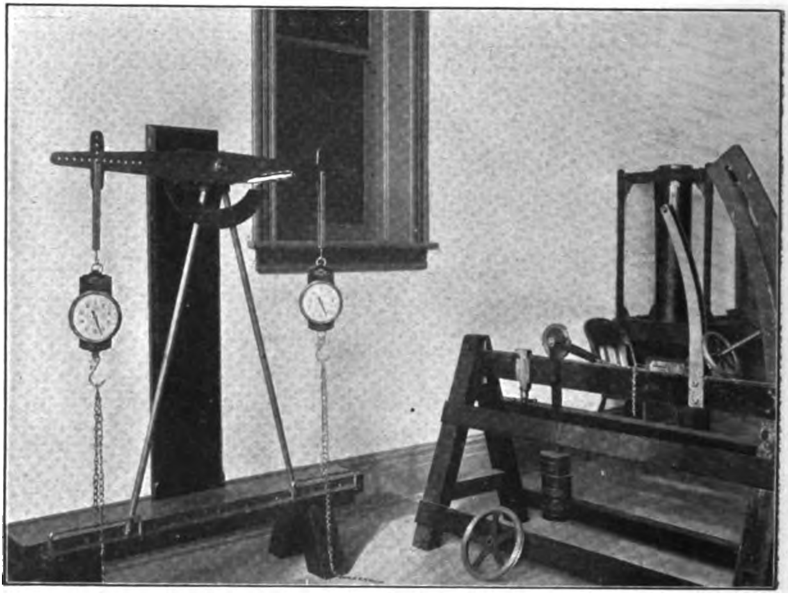
College Pure-Bred Cattle—Shorthorn, Guernsey, Holstein, Hereford.



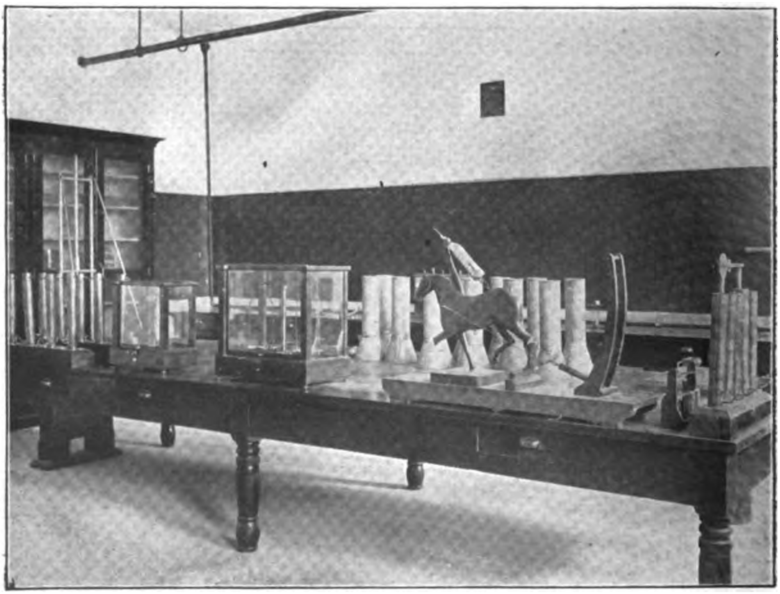
VETERINARY SCIENCE CLASS ROOM.



VEGETATION HOUSE FOR EXPERIMENTAL WORK IN AGRONOMY AND IRRIGATION.

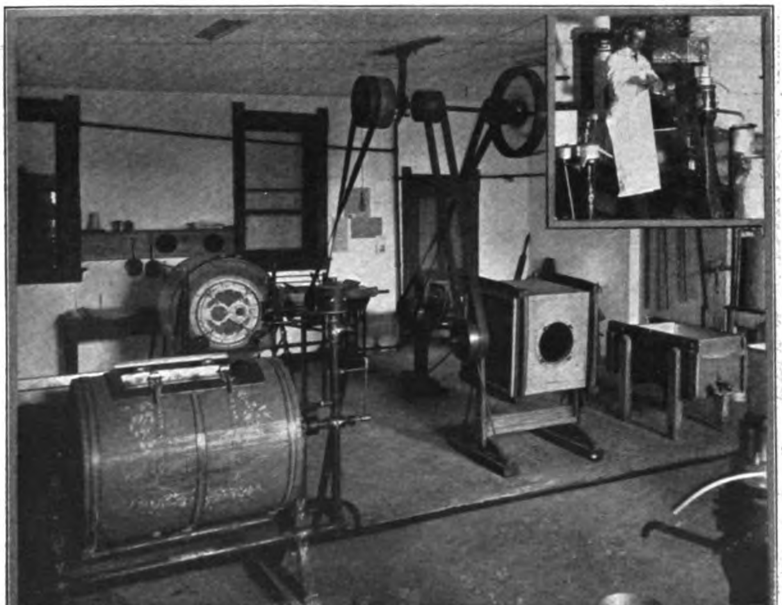


AGRICULTURAL PHYSICS LABORATORY.

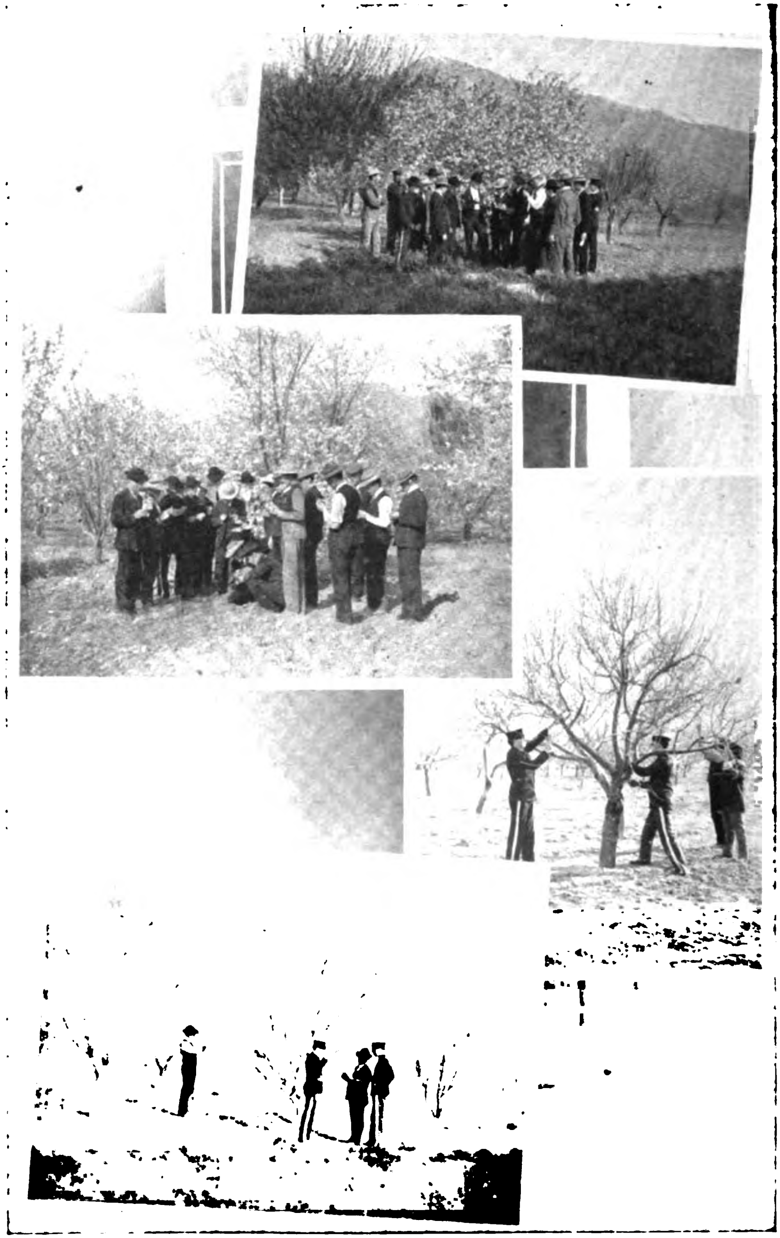


AGRICULTURAL PHYSICS LABORATORY.

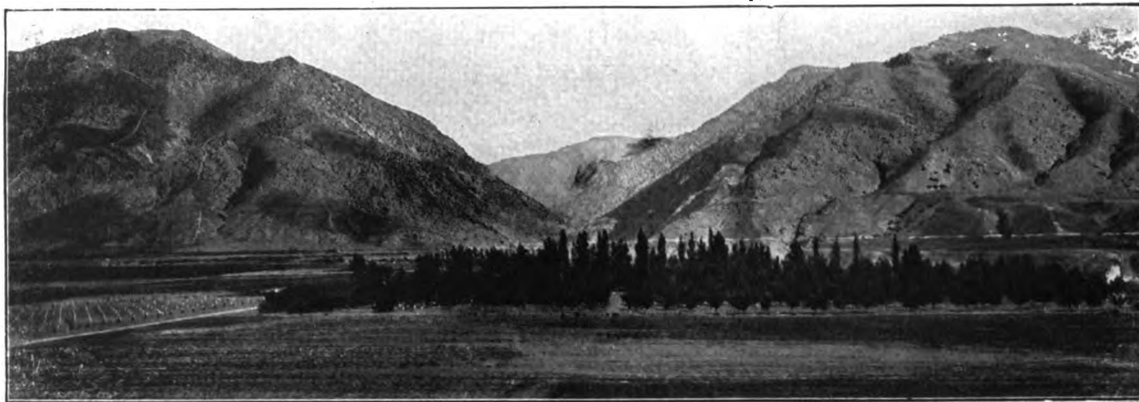
DAIRY—SHOWING SEPARATORS AND BABCOCK TEST.



SECTION OF COLLEGE DAIRY.



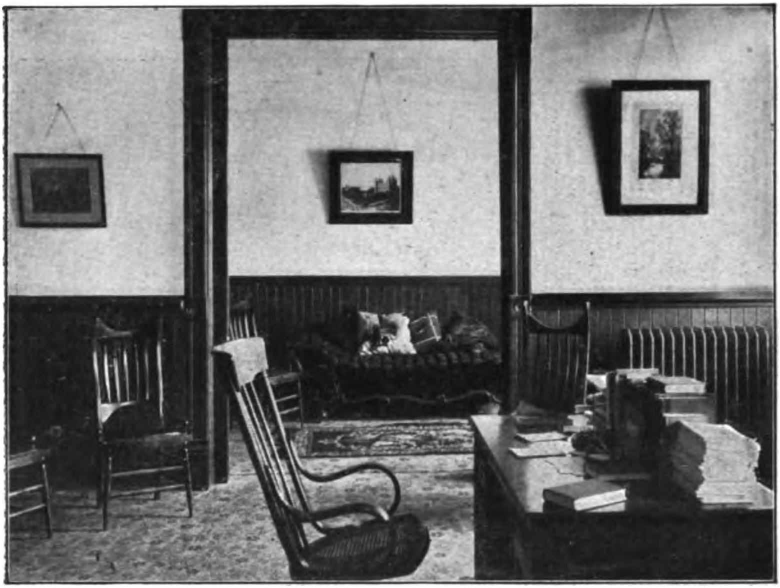
HORTICULTURAL STUDENTS IN ORCHARD.



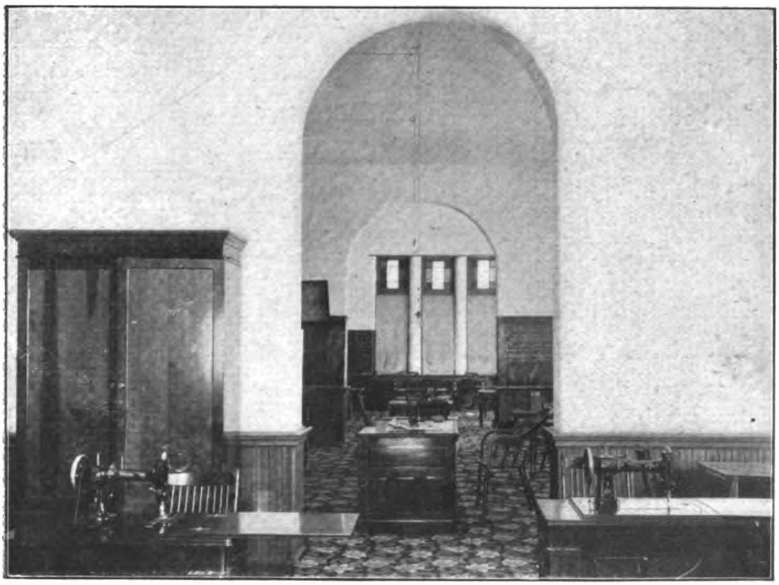
ORCHARD.

VIEW IN COLLEGE ORCHARD.

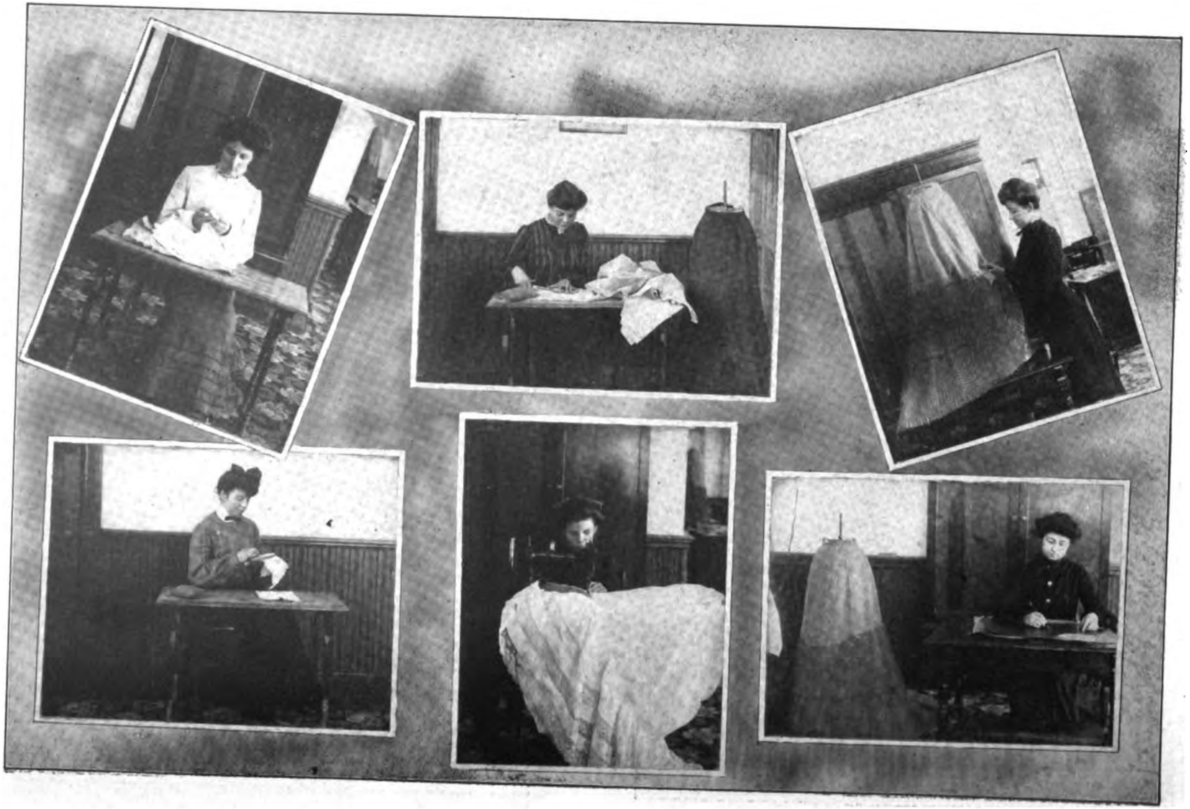
View in Conservatory.



OFFICES, DEPARTMENT OF DOMESTIC SCIENCE AND ARTS.



VIEW IN SEWING ROOMS.

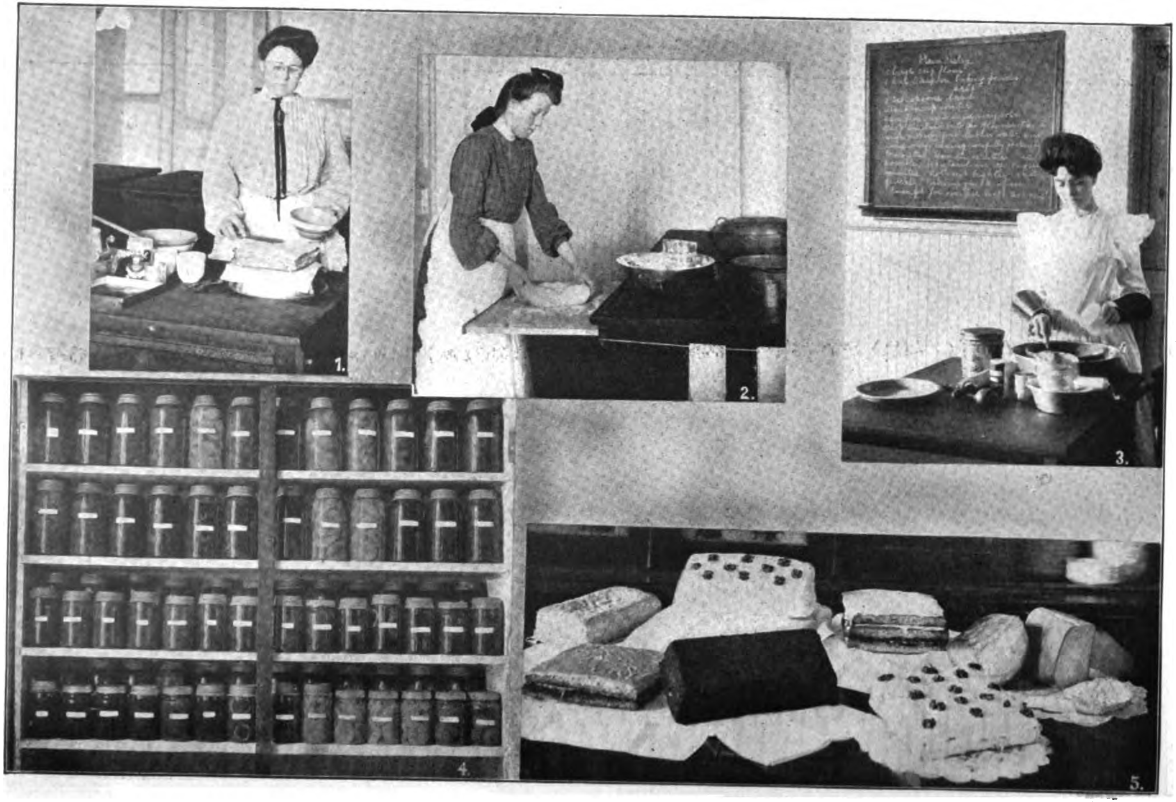


VIEW IN COLLEGE SEWING ROOMS.

College Sewing Rooms, With Samples of Students' Work.

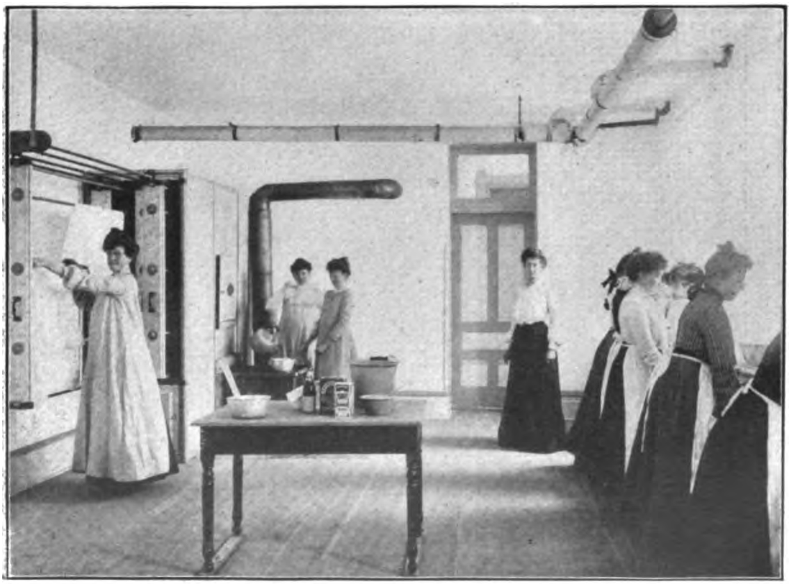
Samples of Students' Work in Sewing.

View in College Kitchens.

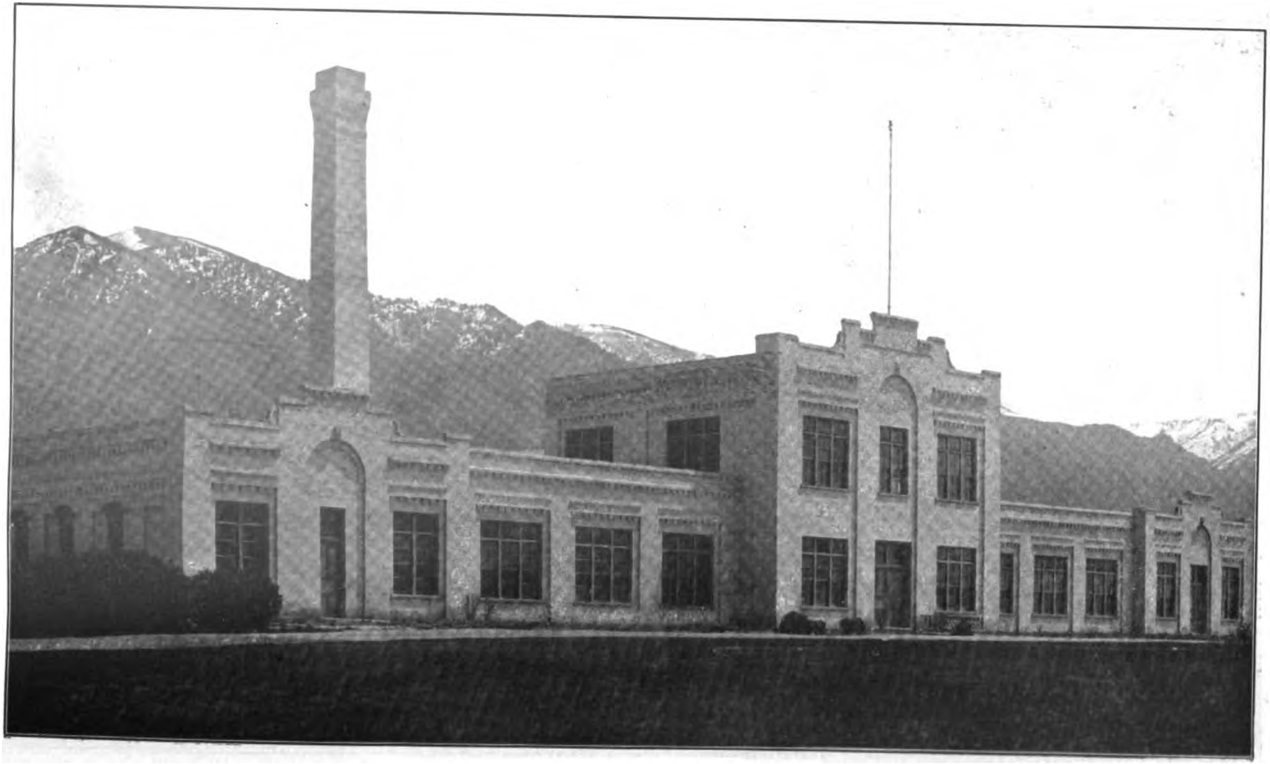


1. Student Making Cake. 2. Student Making Bread. 3. Student Making Pie. 4. Samples of Fruit Bottled by Students. 5. Samples of Cake and Bread Made by Students.

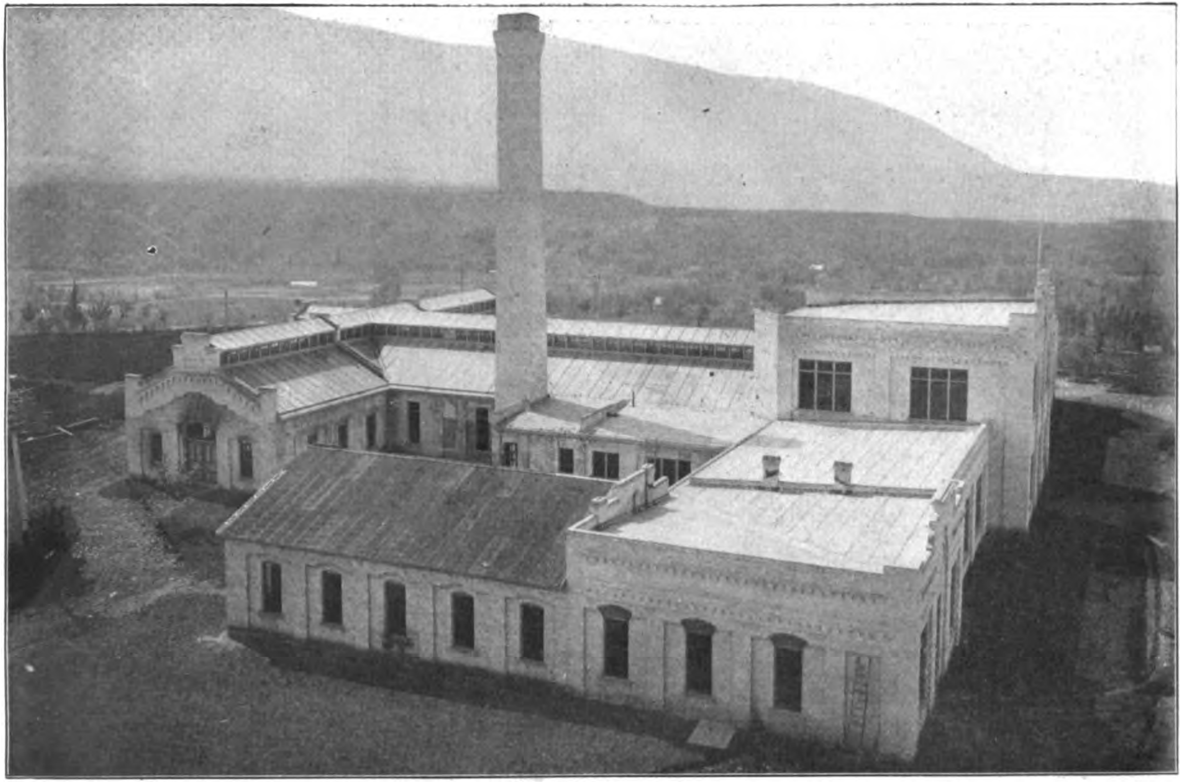
Laundry—Students Ironing.



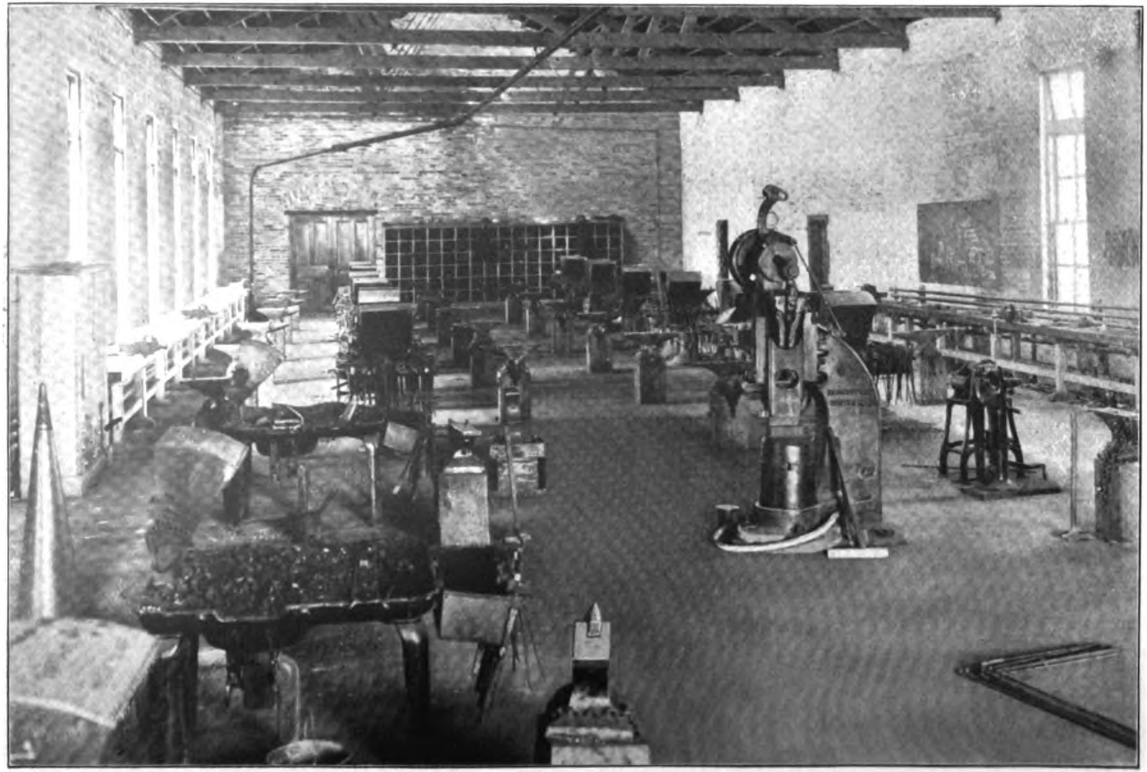
Laundry—A Washing Lesson.



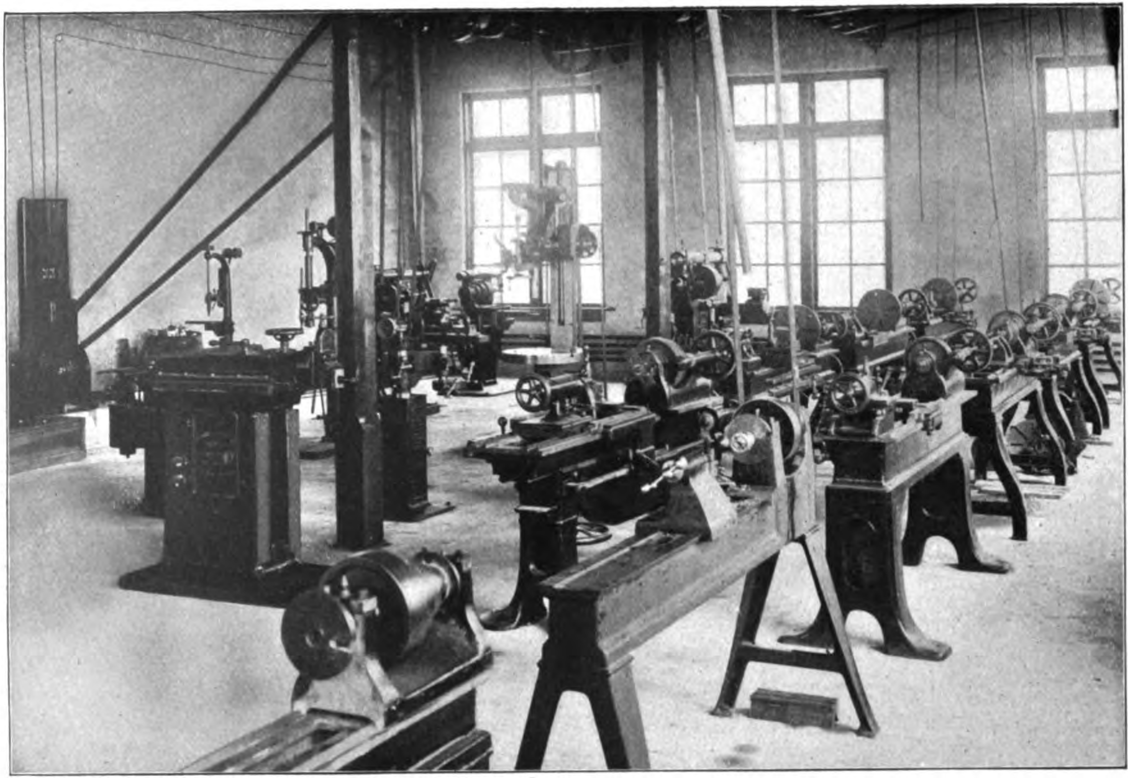
Mechanic Arts Building—Front View.



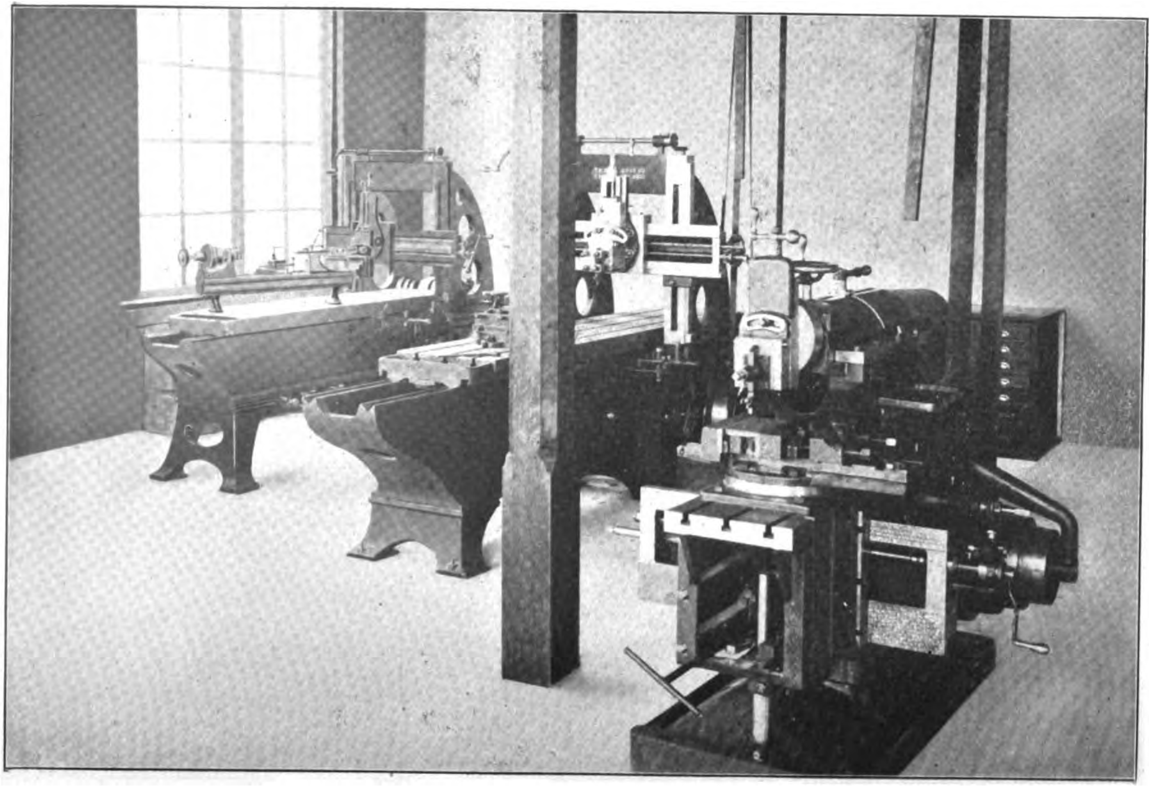
Mechanic Arts Building—From South College Tower.



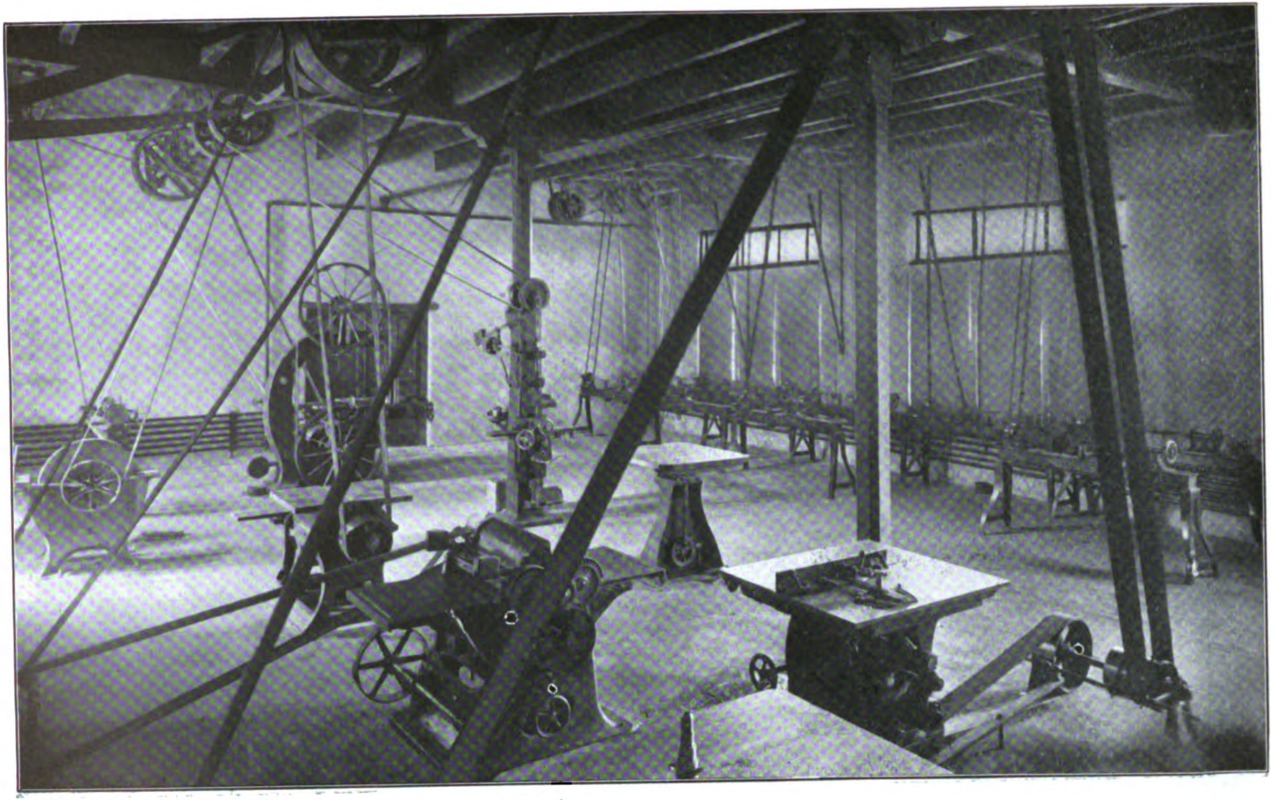
Forge Room.



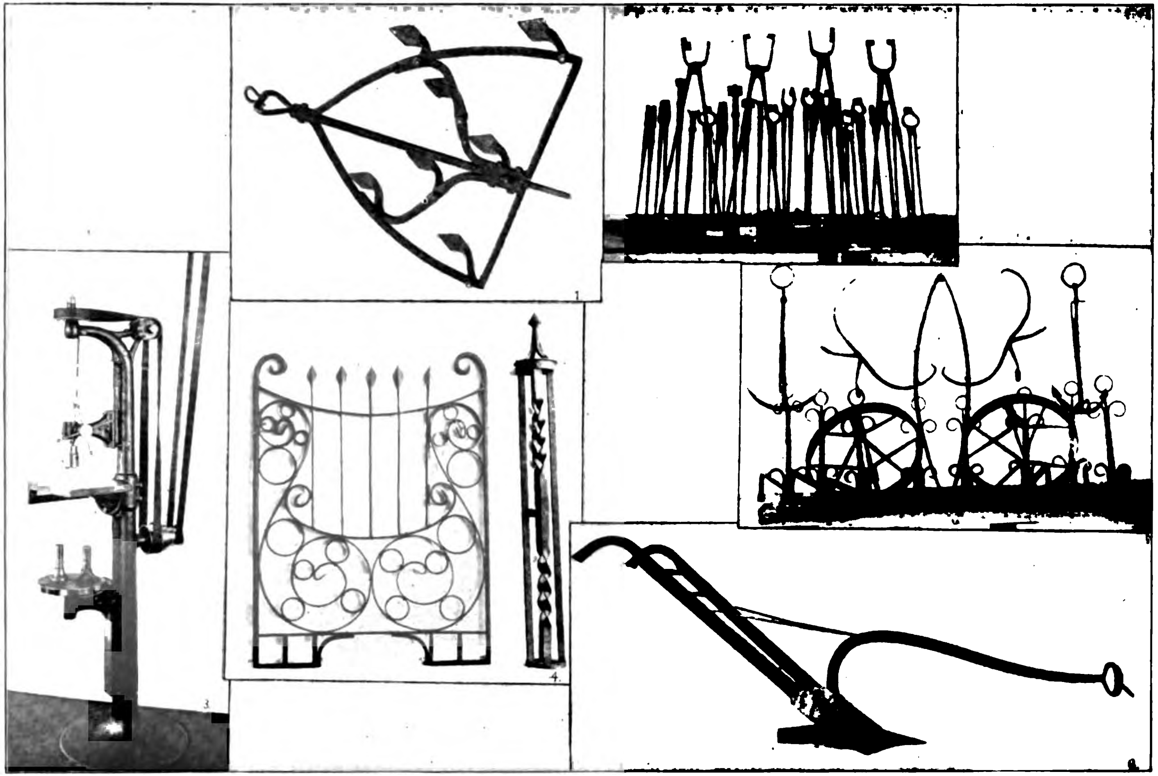
VIEW IN METAL WORKING MACHINE ROOM.



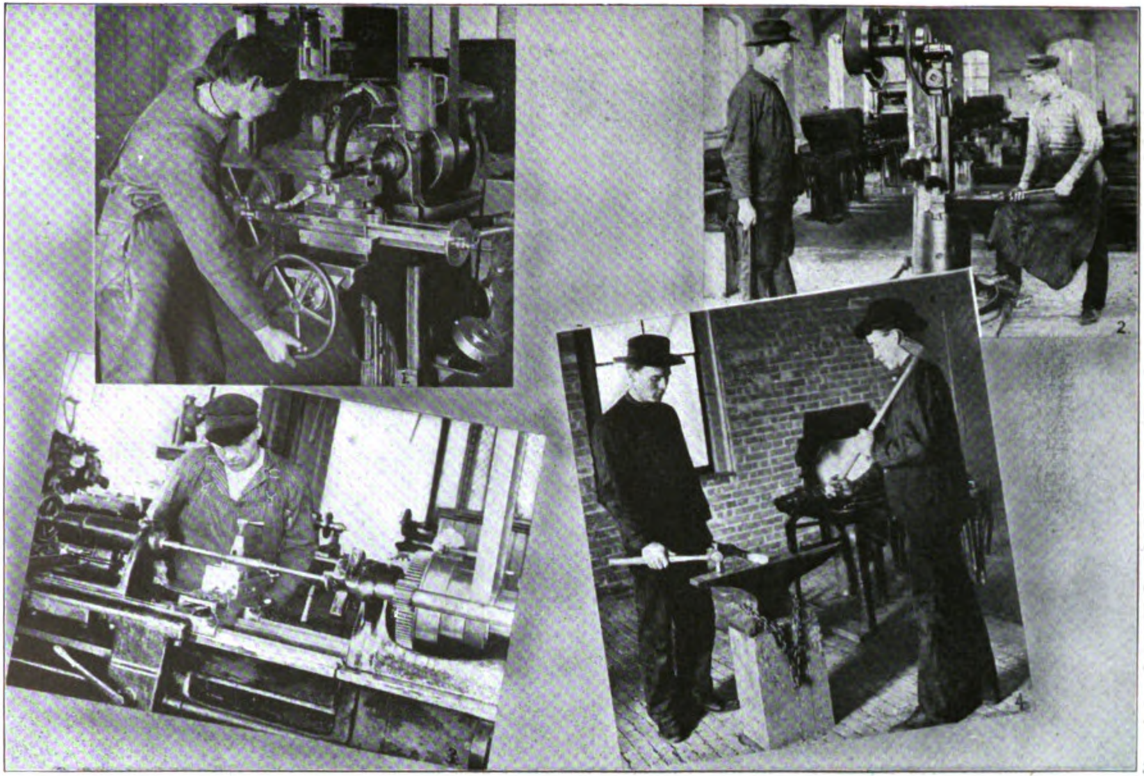
Corner in Metal Working Machine Room.



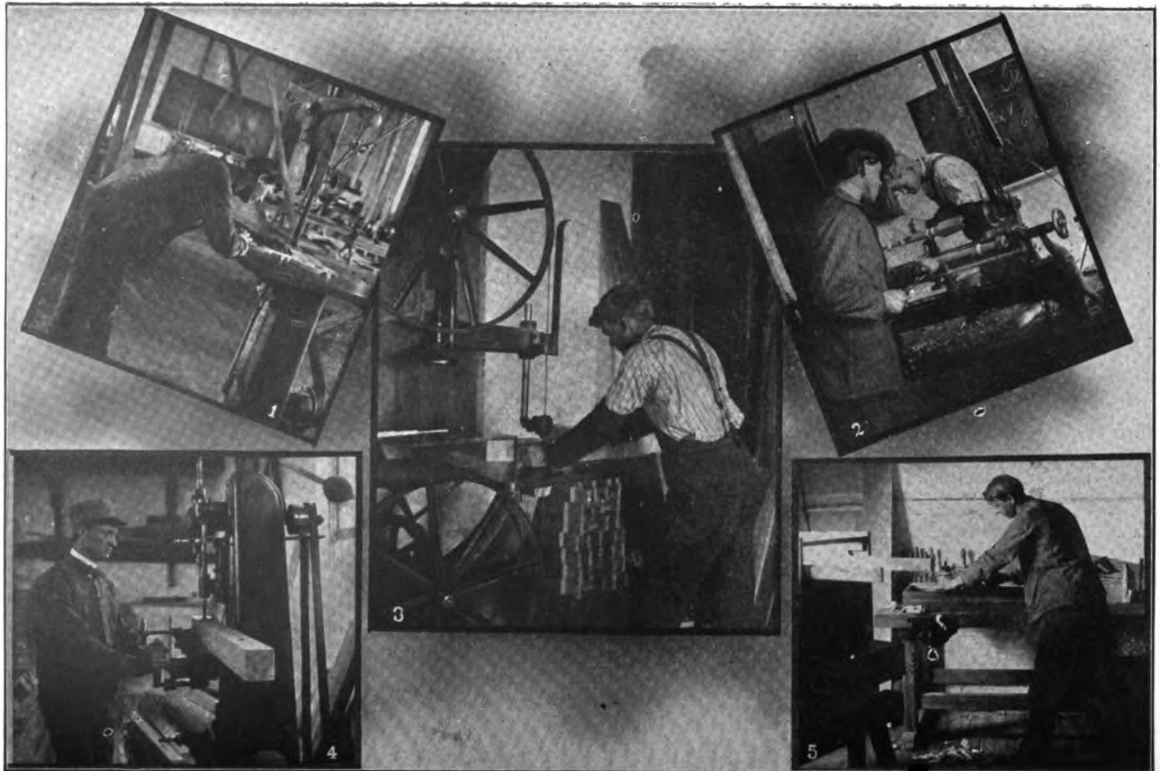
Wood Working Machine Room.



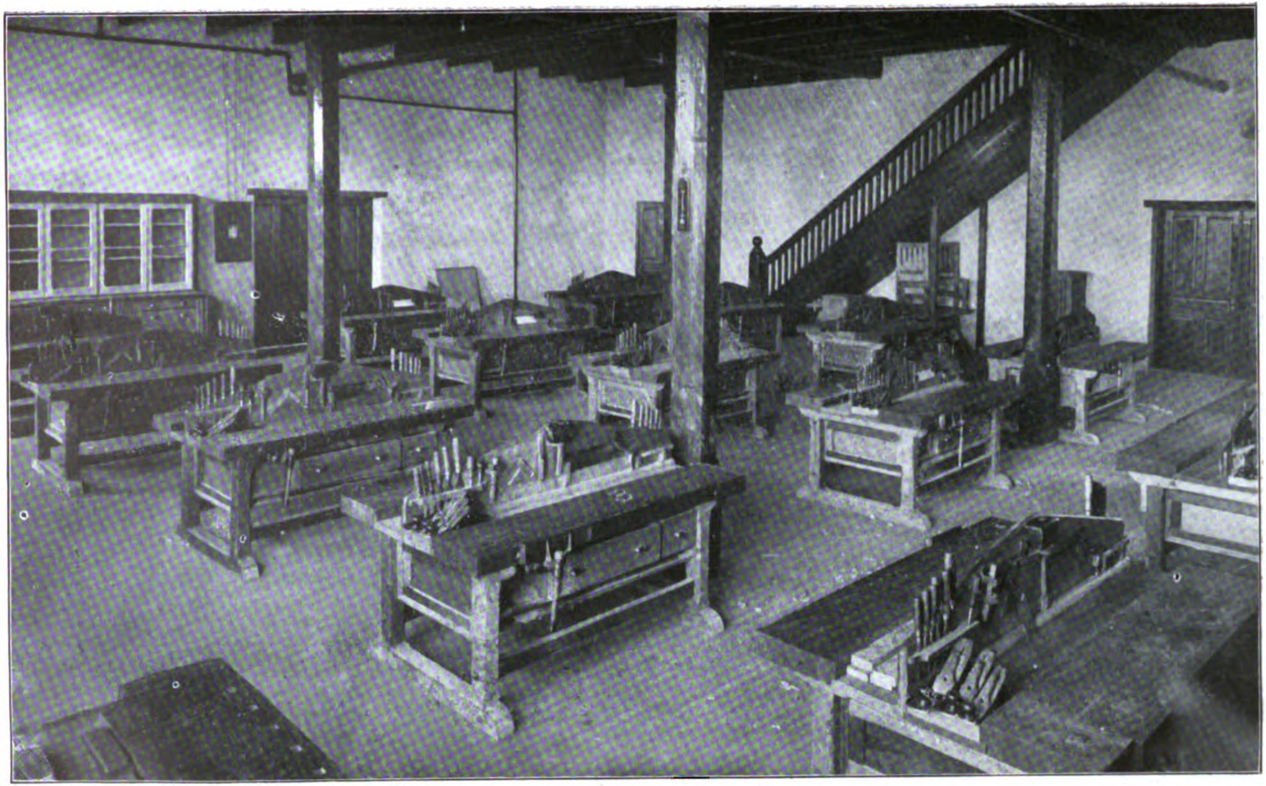
Sample Exercises by Students in Mechanic Arts. Forging and Machine Work.



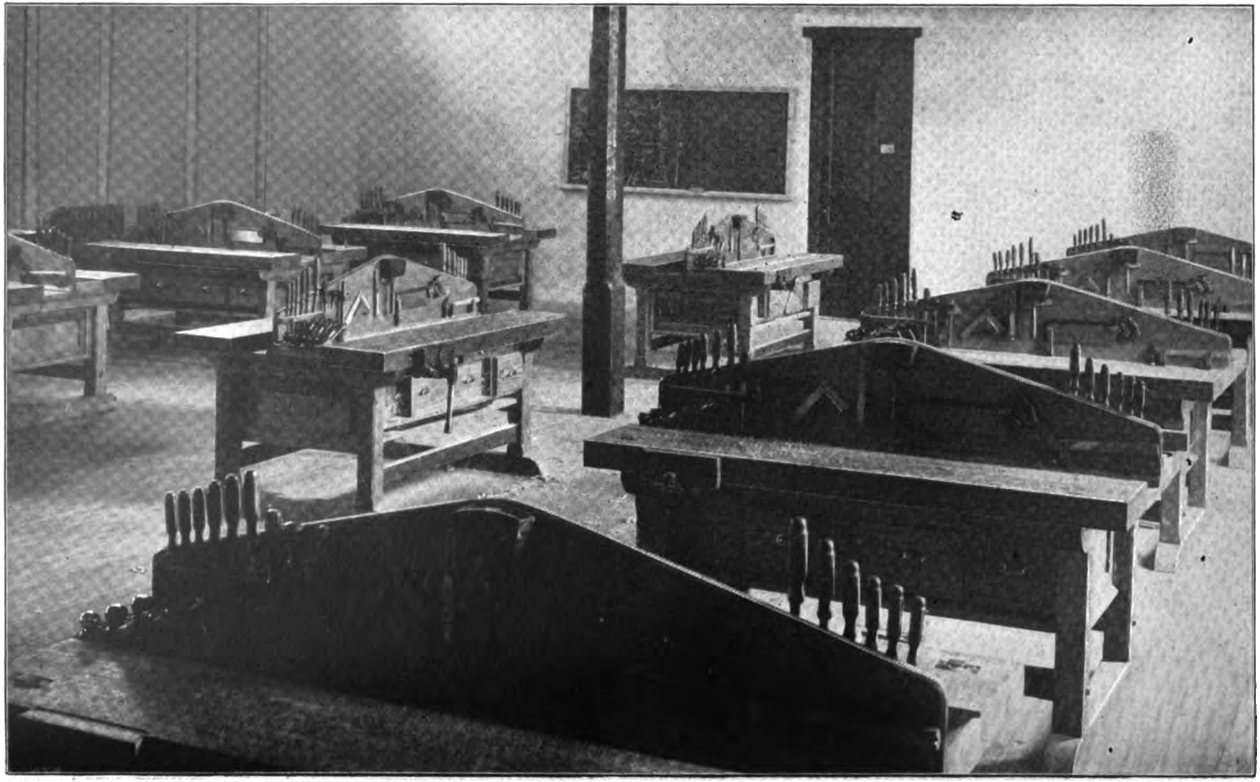
1. Student at Milling Machine. 2. Students at Power Hammer.
3. Students at Lathe. 4. Students at Forge.



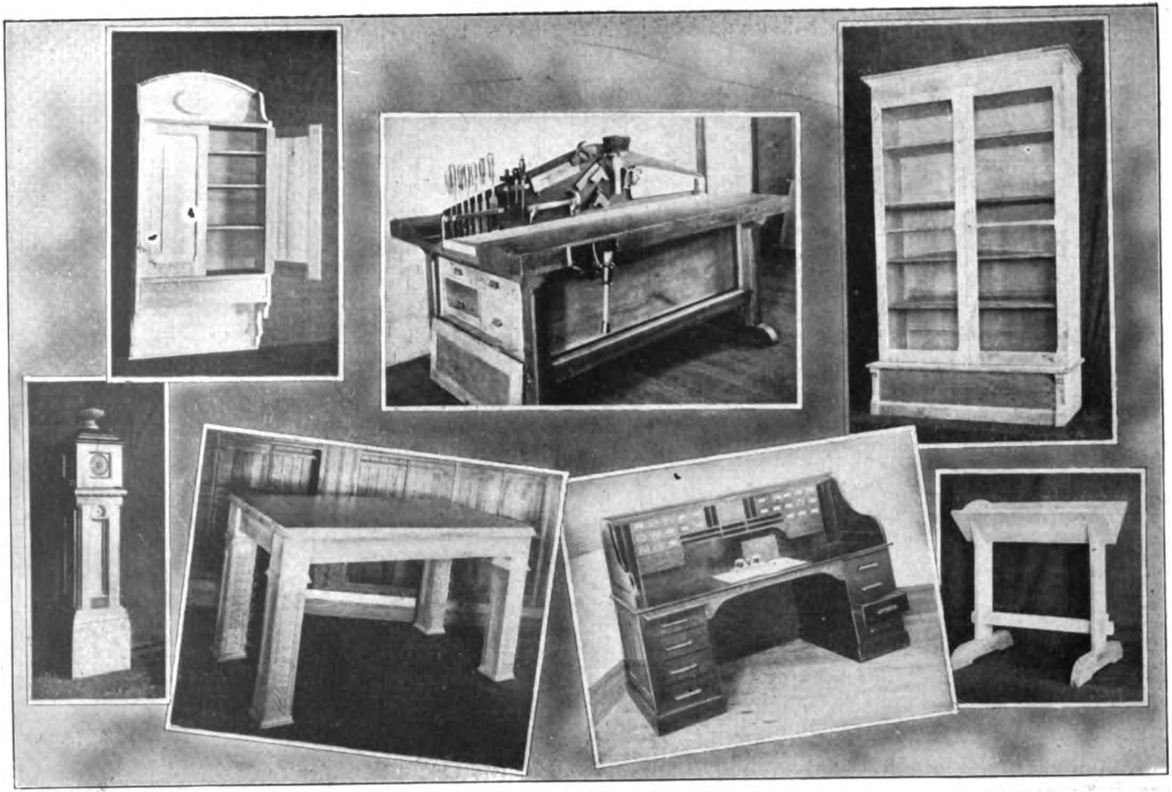
1. Student at Jig-Saw. 2. Student at Turning Lathes. 3. Student at Band Saw. 4. Student at Power Mortiser. 5. Student at Bench.



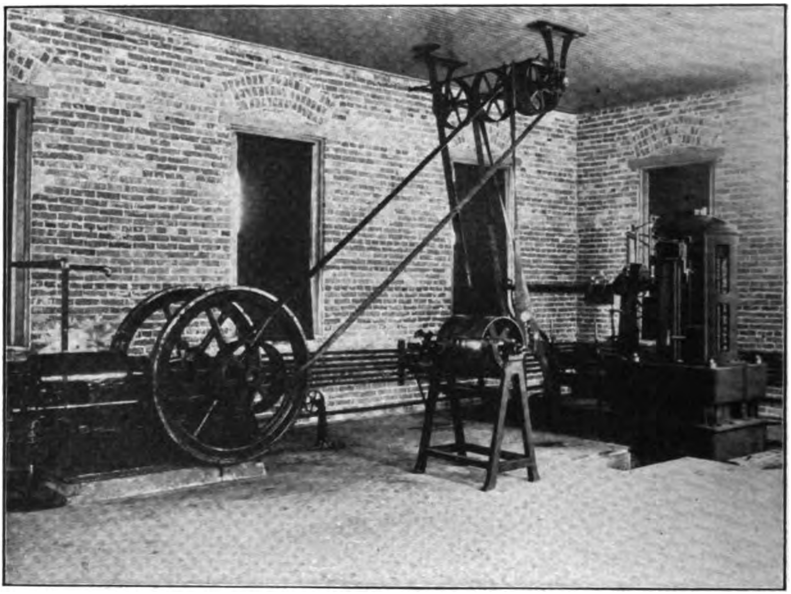
Carpenter Shop.



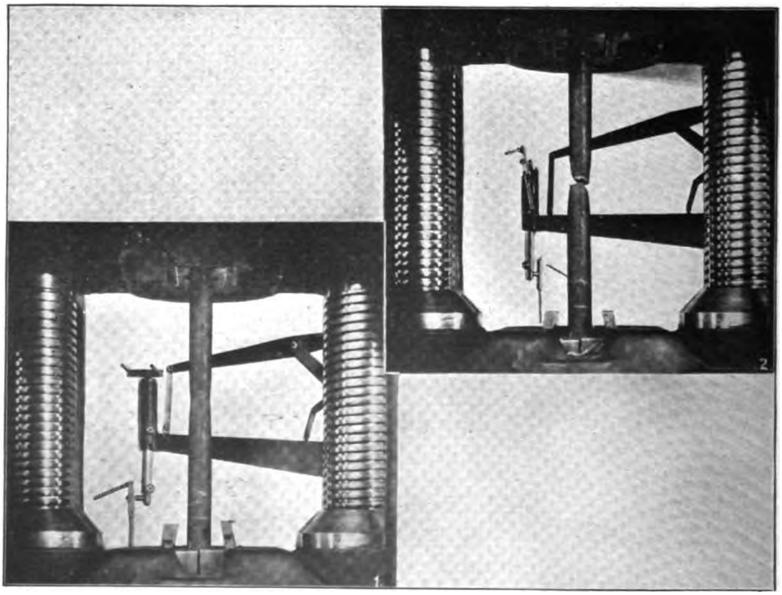
View in Carpenter Shop—Cabinet Work and Pattern Making.



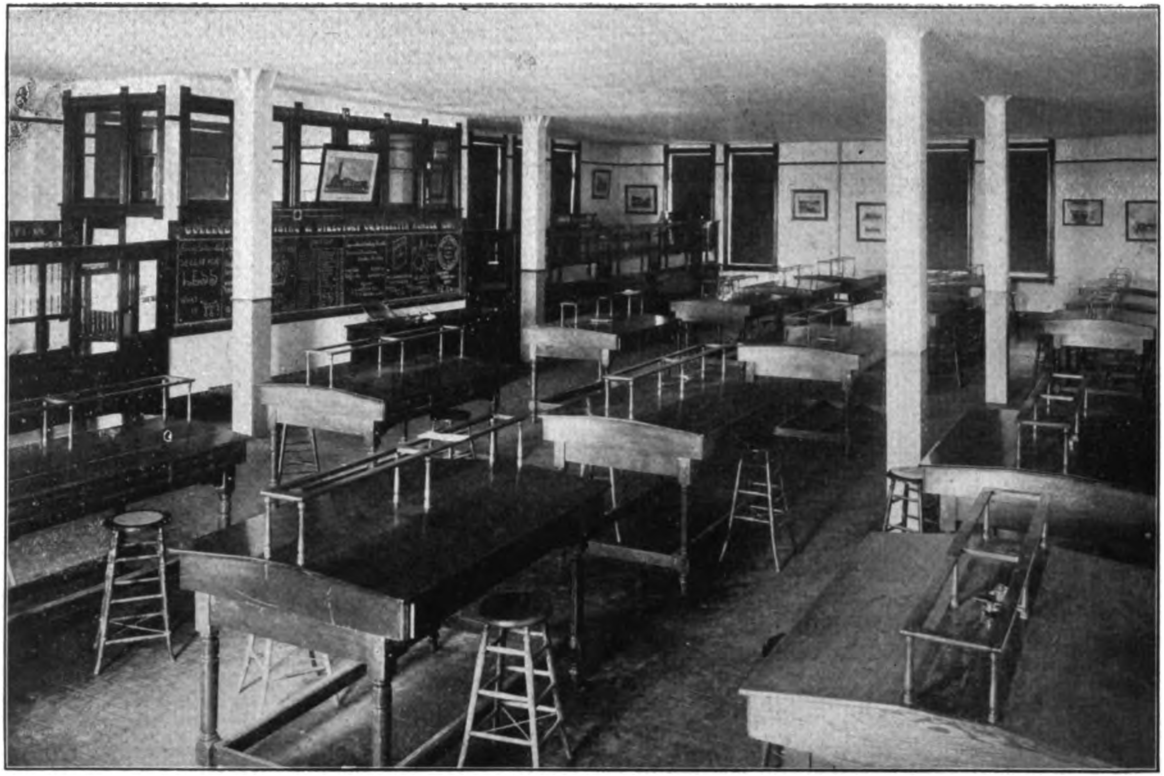
Sample Exercises by Students in Mechanic Arts. Wood Work.



CORNER IN ENGINEERING LABORATORY, SHOWING 200,000 LB.-CAPACITY TESTING MACHINE.



SPECIMEN IN TESTING MACHINE—BEFORE AND AFTER BEING BROKEN.

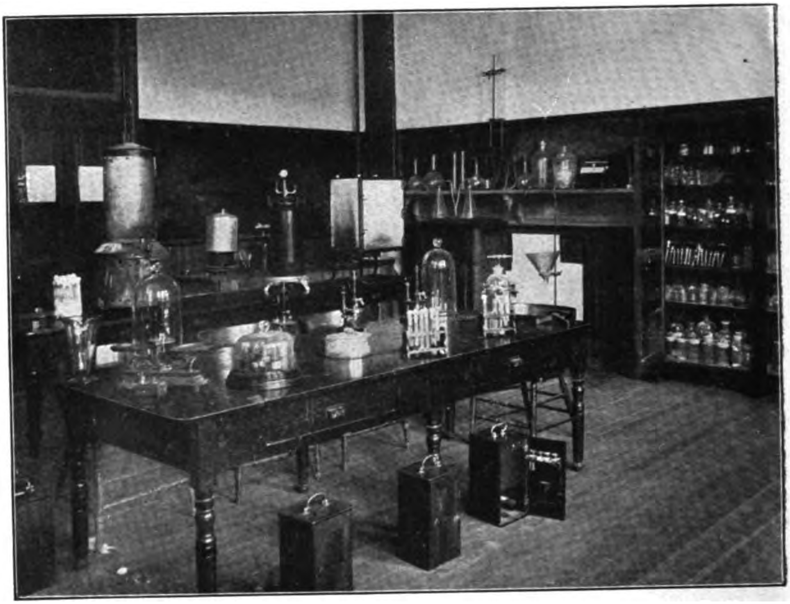


ACCOUNTING ROOM.

Corner in Typewriting Room.

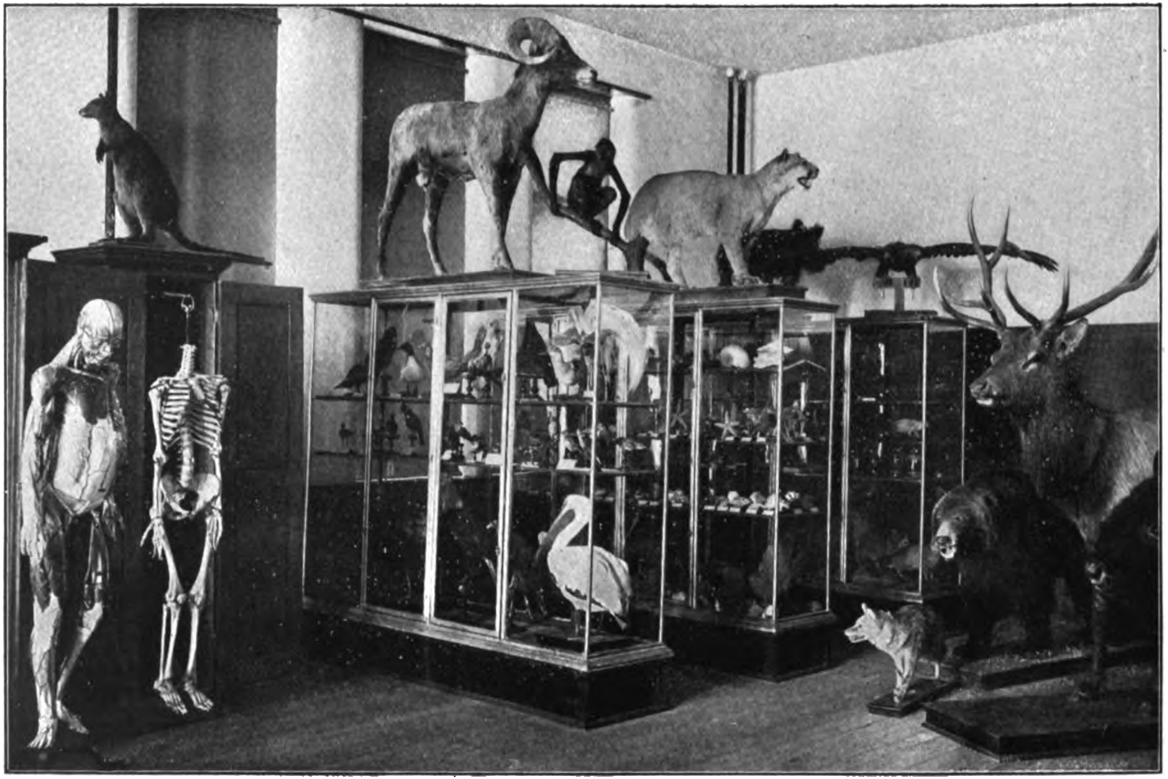
Office and Corner in Commercial Rooms.

VIEW IN CHEMICAL LABORATORIES.

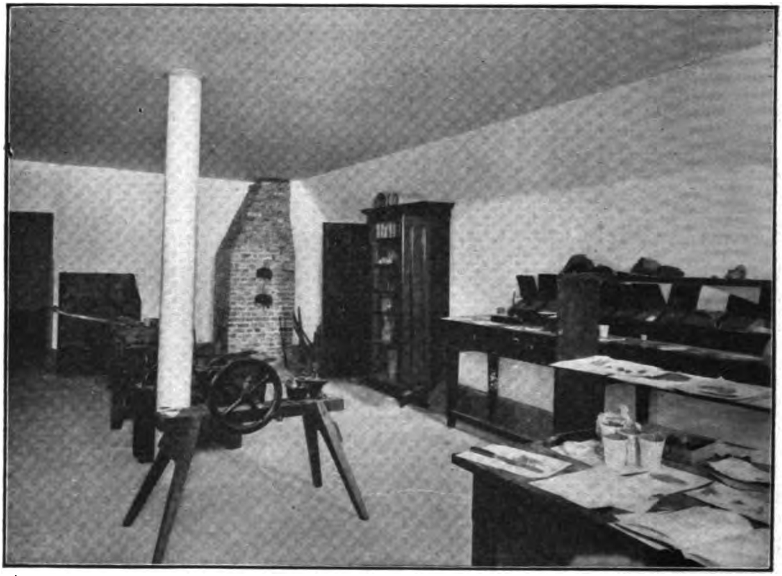


BACTERIOLOGICAL LABORATORY.

ZOOLOGICAL LABORATORY.

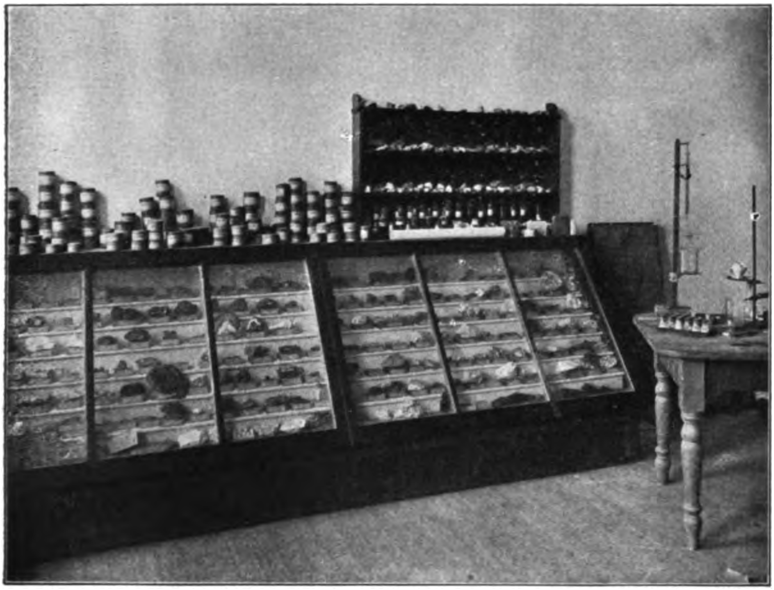


CORNER IN ZOOLOGICAL MUSEUM.



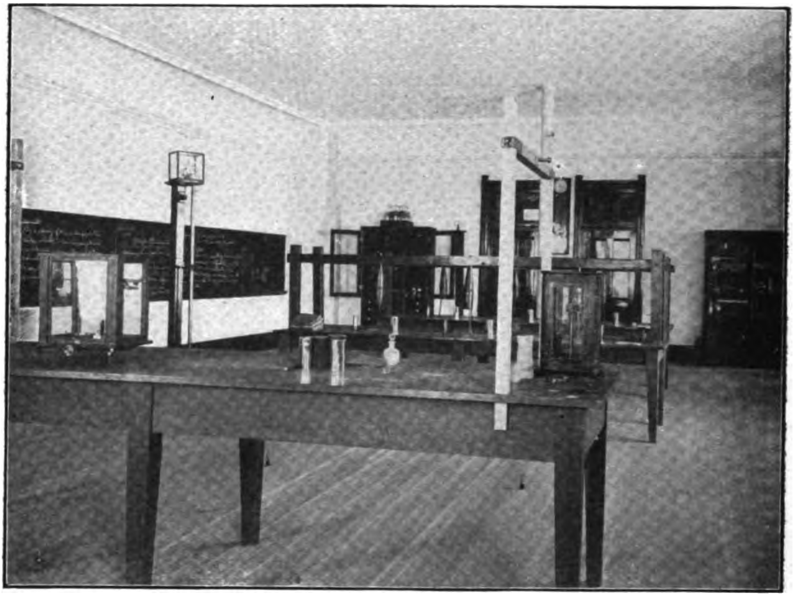
Corner in Assaying Room.

Class Room, Mineralogy.

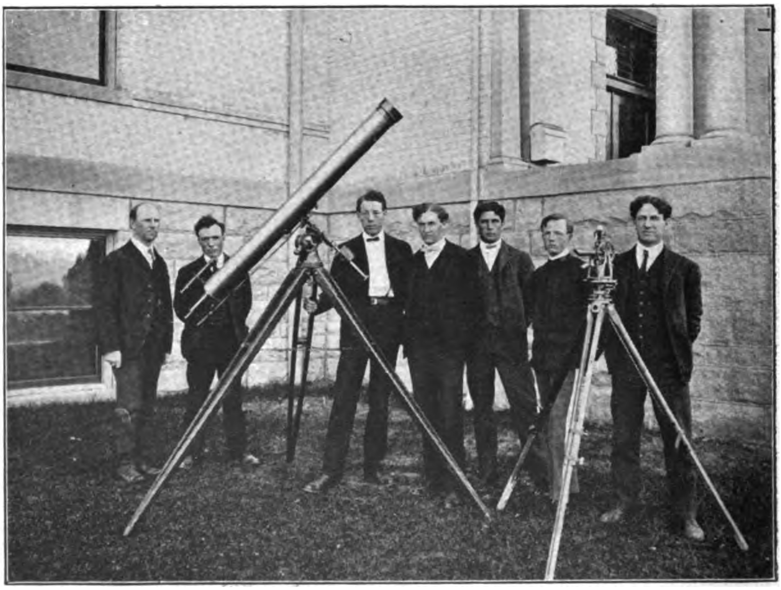


SECTION OF MINERALOGICAL LABORATORY.

SECTION OF MINERALOGICAL MUSEUM.



PHYSICAL LABORATORY.



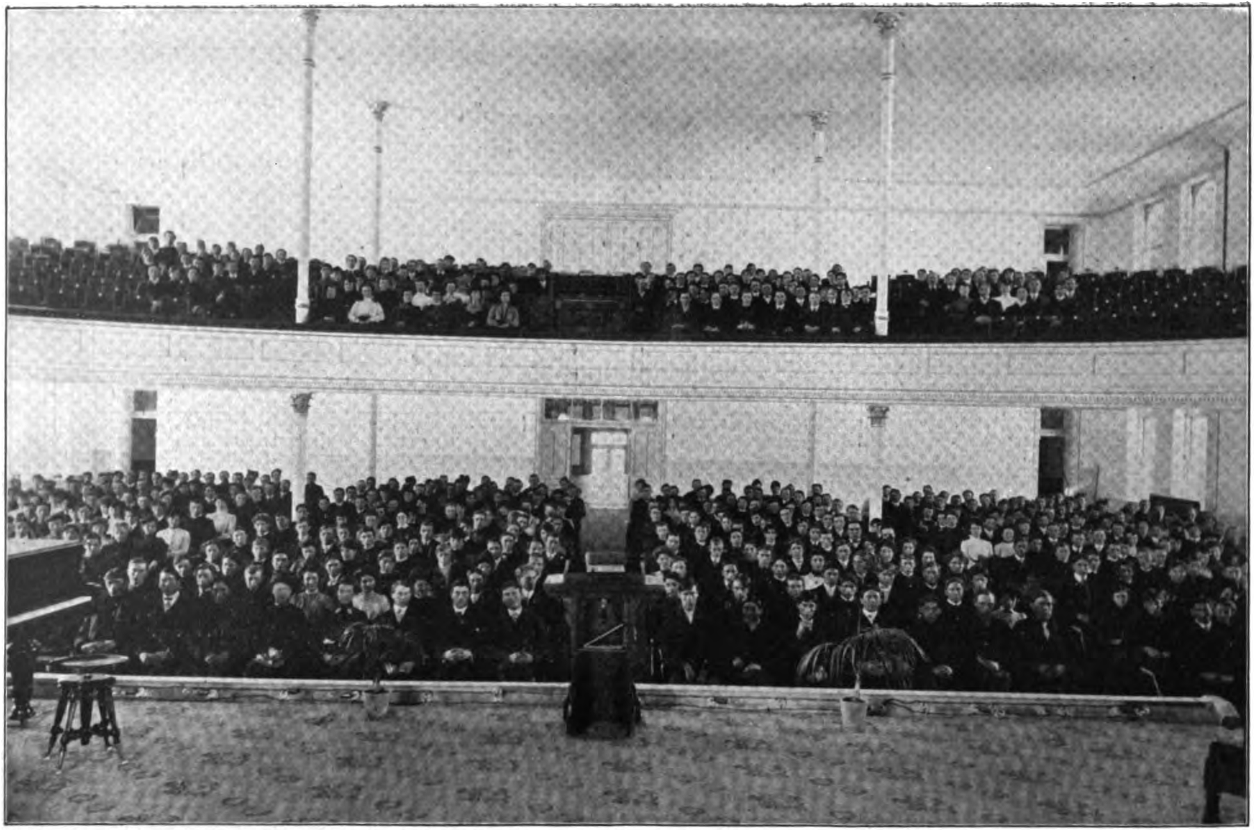
CLASS IN ASTRONOMY.

Stack Room, College Library.

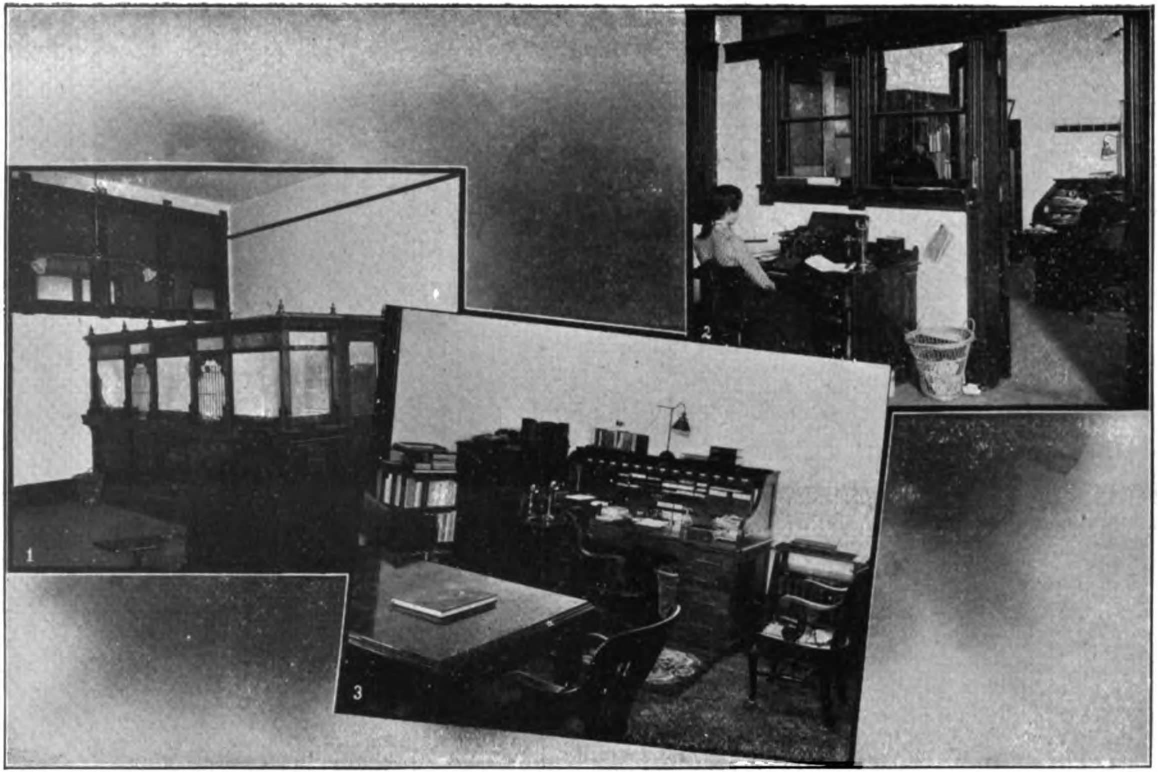
Reading Room, College Library.

Delivery Corner, College Library.

Art Rooms.



College Auditorium.



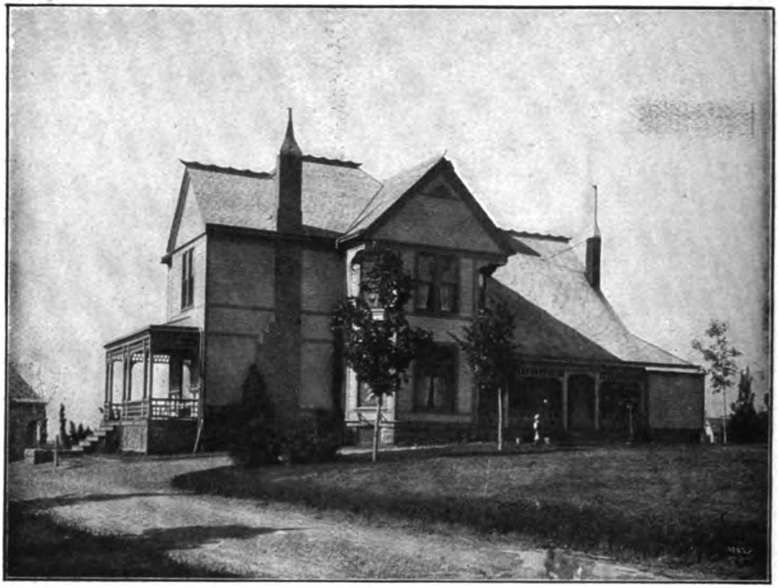
1. Registrar's Office. 2. Secretary's Office. 3. President's Private Office.

Front of Main Building.

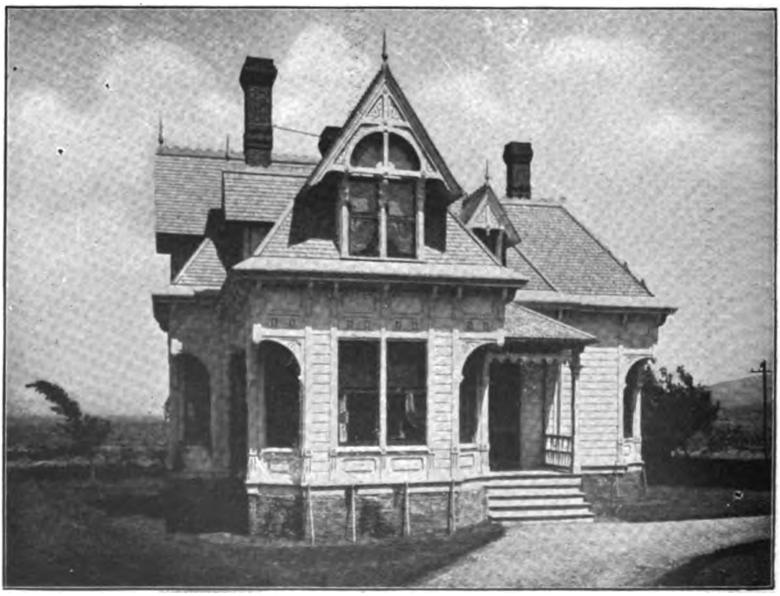
College Dormitory.

RECEPTION ROOM—COLLEGE DORMITORY.

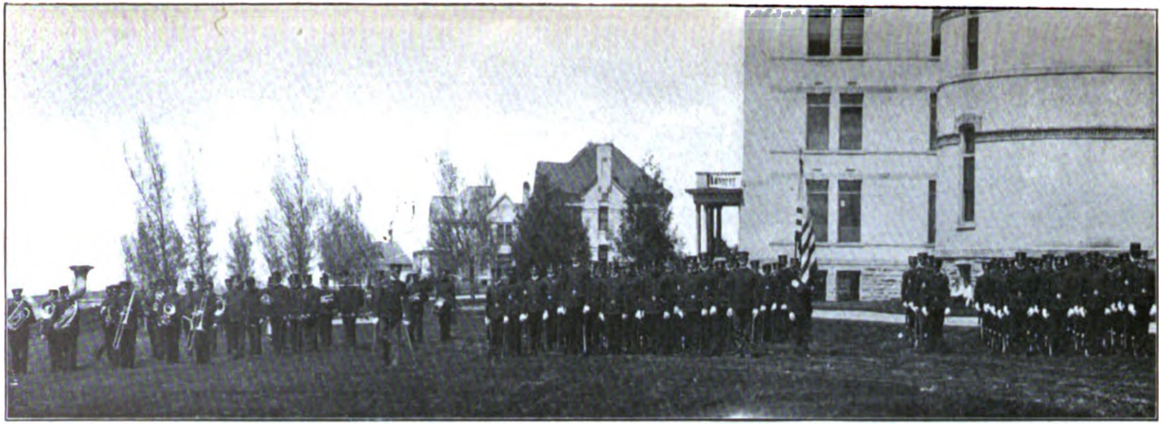
STUDENT'S ROOM—COLLEGE DORMITORY.



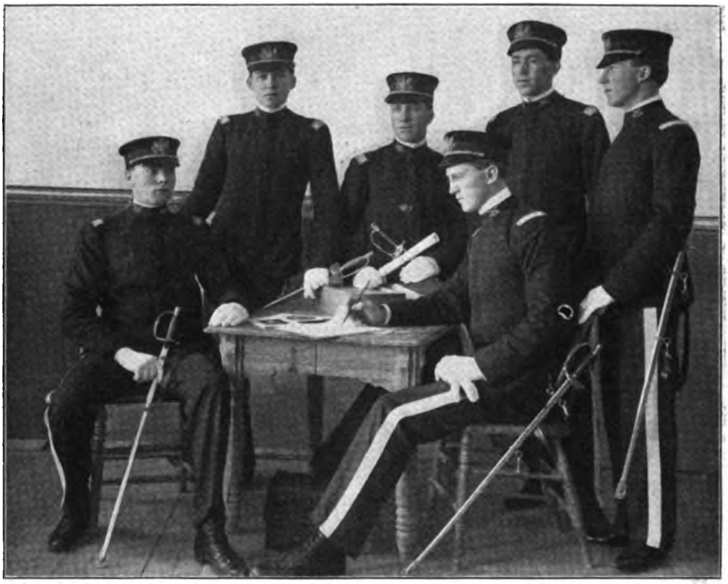
RESIDENCE OF THE PRESIDENT.

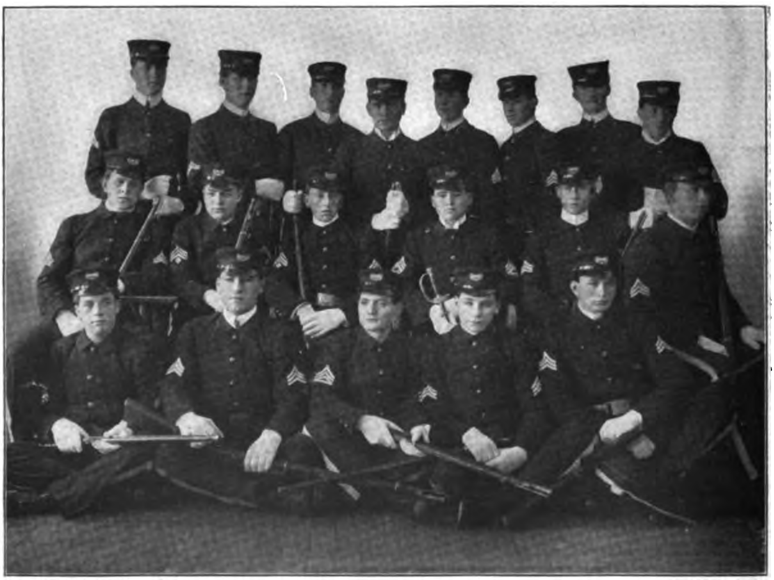


RESIDENCE OF DIRECTOR OF EXPERIMENT STATION.



Cadet Battalion and Skirmish Firing.

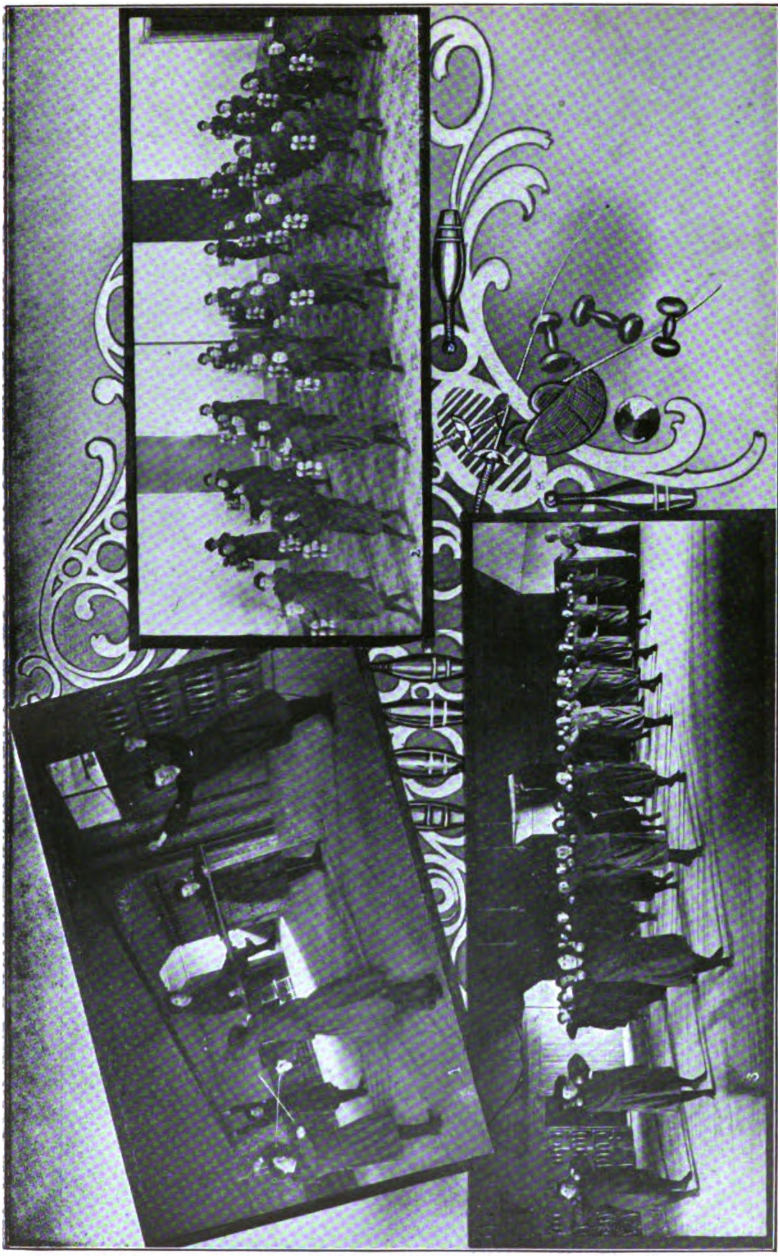


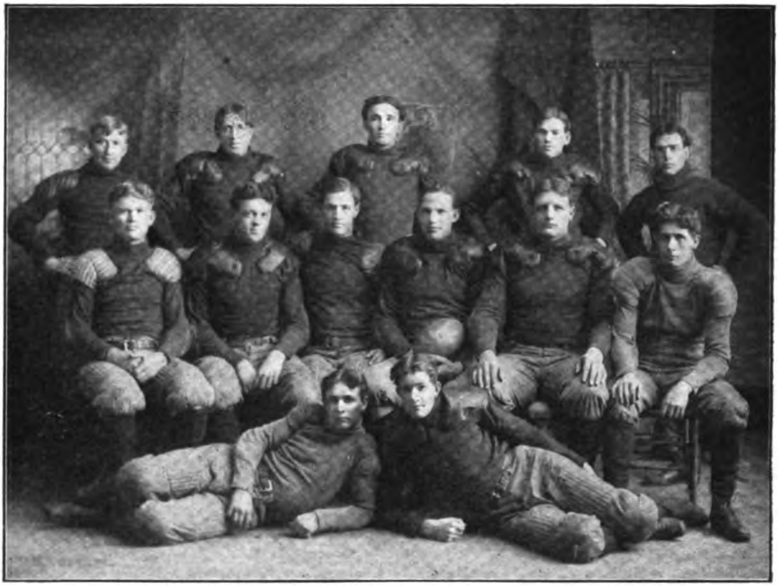


Cadet Officers.

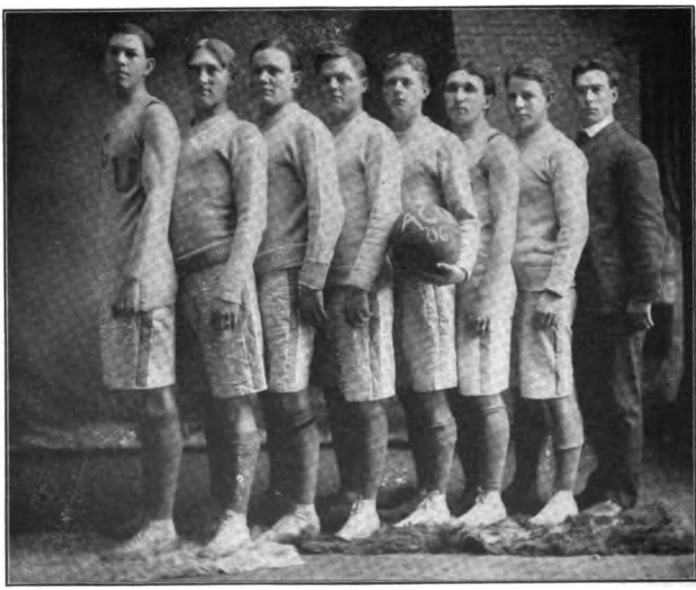
RIFLE TEAM AND OUTPOSTS.

College Military Band.





College Football Team.



College Basketball Team.

AGRICULTURAL COLLEGE OF UTAH.

General Information.

The Agricultural College of Utah constitutes part of the public school system of the State. It comprises five different schools,—the School of Agriculture, the School of Domestic Science and Arts, the School of Commerce, the School of Engineering and Mechanic Arts, and the School of General Science; also the Agricultural Experiment Station, which, while not providing directly for instructional work, is one of the most important departments of the institution. The organization, purpose, and equipment of the College, together with the character and extent of the work offered, are described, so far as the limits of space will allow, in the following statements and schedules.

FOUNDATION AND ENDOWMENT.

An Act of Congress, approved July 2, 1862, provided that public lands should be granted to the several states, to the amount of "thirty thousand acres for each Senator and Representative in Congress," from the sale of which lands there should be established a perpetual fund, "the interest of which shall be inviolably appropriated, by each state which may take and claim the benefit of this act, to the endowment, support and maintenance of at least one college, where the leading object shall be, without excluding other scientific and classical studies and including military tactics,

to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." The Act forbids the use of any portion of the aforesaid fund, or of the interest thereon, for the purchase, erection, or maintenance of any building or buildings. The states accepting the provisions of the Act are required to provide for the construction and maintenance of the necessary buildings, and for the expenses of administration in carrying out the purpose of the Act.

On March 8, 1888, the Utah Legislative Assembly accepted the national law, and, in accordance with its provisions, founded the Agricultural College of Utah. The amount of public lands granted to this institution, under the provisions of the Act of Congress, was 90,000 acres; but by the terms of the Enabling Act, passed by Congress and approved July 16, 1894, providing for the admission of Utah as a state, the amount was increased to 200,000 acres.

Under an Act of Congress, approved March 2, 1887, the College receives $15,000 annually for the maintenance of the Agricultural Experiment Station, "to aid in acquiring and diffusing among the people useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science."

Under an Act of Congress, approved August 30, 1890, the College receives $25,000 annually, "to be applied only to instruction in agriculture, mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic science, with special reference to their application to the industries of life."

In addition to the income from the national government and from the land grant fund, the College is dependent upon the State Legislature for such appropriations as are needed to meet the requirements of the several departments in accordance with the pro-

visions of the Acts of Congress, and to provide for the further development of the institution consistent with the educational and industrial demands of the state.

HISTORY.

In 1888, the Legislature appropriated $25,000 for buildings, and the county of Cache and the city of Logan gave one hundred acres of land on which to locate the College. Plans were prepared for the Main Building, and part of the south wing was completed. In September, 1890, the institution was first opened for the admission of students. Regular courses were offered in Agriculture, Domestic Arts, Civil Engineering, Mechanic Arts, and Commerce; also a Preparatory Course, and special courses in Agriculture, Mining Engineering, and Irrigation Engineering.

The Legislature of 1890 appropriated $48,000 for the construction of an Experiment Station Building, two laborers' cottages, and a farm house, and for the purchase of apparatus and the employment of administrative officers. The Legislature of 1892 provided $108,000 with which the south wing, the north wing, and part of the center of the Main Building were completed; rooms in the basement were provided with machinery and other facilities for shopwork; the scientific laboratories were more thoroughly equipped; and other additions were made which added greatly to the facilities of the institution for advanced work. In 1894, additional apparatus was provided, and a forcing house and a veterinary laboratory were constructed. In 1896, the Legislature passed a law providing an annual appropriation to the College of $1500 for the purpose of holding Farmers' Institutes in the different counties of the State. During this year, part of the Mechanic Arts Building was completed, and the forge shops were removed from the Main Building. In 1897, the Legislature made an appropriation for the maintenance of a Manual Training School, and for the extension of the Mechanic Arts Building, providing rooms for the chemical laboratories and the carpentry and

machine shops; manual training courses were established in Mechanic Arts and Domestic Arts. In 1899, a greenhouse was constructed and equipped. In 1900, a department of art was established, additional class rooms were furnished, several departments throughout the institution were more thoroughly organized, and other improvements were made, adding to the facilities for thorough and efficient work. The Legislature of 1901 appropriated $108,200 for general maintenance and various improvements, including the completion of the front of the Main Building, the construction of model farm buildings and a vegetation house, and the purchase of further apparatus and of additional land for work in irrigation investigations.

In March, 1901, the Sub-Freshman Course and the elementary courses in Agriculture and Commerce were abolished, and regular three-year courses of high school grade were established in Agriculture, Domestic Science and Commerce, each leading to a certificate of graduation. The Manual Training Course in Mechanic Arts was increased from three to four years, and the Manual Training Course in Domestic Arts was increased from two to three years. An additional year's work was prescribed for admission to the baccalaureate courses, thereby raising the standard of the regular College work one year. These College courses in Agriculture, Domestic Science, Commerce, Engineering, and General Science, were made co-ordinate and were more clearly differentiated from the elementary or high school courses.

The Legislature of 1903 appropriated $110,975 for general maintenance and for additional buildings and equipment. An appropriation of $12,500 was also made for experimental work in dry farming, to be conducted by the College in different parts of the State. In March, 1903, the Board of Trustees established five schools: the School of Agriculture, the School of Domestic Science and Arts, the School of Engineering and Mechanic Arts, the School of Commerce, and the School of General Science. The College Council was also established and a more complete organization effected throughout all the departments of the institution.

GOVERNMENT.

The government of the College is vested primarily in the Board of Trustees, and, under their control, the three other administrative bodies,—the College Council, the College Faculty, and the Staff of the Experiment Station. These, in their several capacities, determine the policy and maintain the efficiency of the institution.

THE BOARD OF TRUSTEES consists of seven members, appointed by the Governor with the approval of the State Senate. This board assumes the legal responsibility of the institution, cares for its general interests, and directs its course by the enactment of all necessary by-laws and regulartions. Vested in it is the power to establish professorships and to employ the instructing force and other officers of the College.

STANDING COMMITTEES OF THE BOARD OF TRUSTEES. Between sessions, the power of the trustees rests with an executive committee, whose actions are referred to the Board for their approval. Another committee is concerned with the funds and accounts of the College, while a third has general charge of all building and repairs throughout the institution. In addition to these, there are committees, largely advisory, having to do with the employment and service of College officers, and with the work of particular departments.

THE COLLEGE COUNCIL consists of the President of the Board of Trustees, the President of the College, and the professors, the associate professors, and the assistant professors. All the important questions of discipline and policy are considered by this body. Its duties extend to the arrangement and correlation of courses of study, the requirements for admission and graduation in the several courses, and the final measures of discipline in cases of flagrant violation of College rules.

THE STANDING COMMITTEES OF THE COUNCIL are, with two exceptions, representative of the several schools of instruction in the College. They have charge of the enrollment and progress of students in the respective schools, and have general direction of the work there carried on. The Committee on Scholarship and Graduation investigates the records of all candidates for certificates and degrees, and makes recommendations to the Council. To another committee of the Council is delegated the duty of arranging and carrying on Farmers' Institutes throughout the State.

THE COLLEGE FACULTY includes the President, the professors, the associate professors, the assistant professors, the librarian, the instructors, and the assistants. As an administrative body it is concerned with the ordinary questions of methods and discipline and with various matters pertaining to the general welfare of the College. Through its standing committees it is in more intimate contact with the student body and with the life and interests of the college community.

THE STANDING COMMITTEES OF THE FACULTY have delegated to them the immediate direction of various phases of college life. The conduct of the student in his college home and his regularity in performing college duties; the publications of the College and the students; the interests of the students on the athletic field, in the amusement halls, and in their various organizations—all these things are within the province of appropriate committees experienced in the management of such matters.

THE EXPERIMENT STATION STAFF consists of the President of the College, the Director of the Station, and the chiefs, with their assistants, of the departments of Agronomy, Horticulture, Animal Industry, Entomology, Chemistry, Irrigation Engineering, and Poultry Culture. This body is employed in the investigation of problems peculiar to agriculture in this portion of the country, the purpose being to improve conditions and results. It is further responsible for the circulation, through private correspondence

and regular bulletins, of such information as is of practical value to the farming communities.

THE STUDENTS. The College is maintained at public expense for the public good. The students, therefore, are under a peculiar obligation to perform faithfully all their duties to the state, the institution, and the community. Most important of these is an active interest in all that concerns the moral and intellectual welfare of the College. Regularity of attendance, faithful attention to studies, and exemplary personal conduct are insisted upon at all times, and the administrative bodies of the College are fully empowered to secure these results.

POLICY.

It is the policy of the Agricultural College of Utah, in accordance with the spirit of the law under which it is organized, to provide a liberal, thorough, and practical education. The two extremes in education, empiricism and the purely theoretical, are avoided, the practical being based upon, and united with, the thoroughly scientific. All the practical work, on the farm, in the orchards, vineyards, gardens, dairy, commercial rooms, kitchen, sewing rooms, different scientific laboratories, and carpentry, forge, and machine shops, is done in strict accordance with scientific principles. In addition to the practical work of the different courses, students are thoroughly trained in the related subjects of science, and in mathematics, history, English, and modern languages. While the importance of practical training is emphasized, the disciplinary value of education is kept constantly in view. It is recognized that the mind and eye and hand must be trained together in order to secure symmetrical development. The object is to inculcate habits of industry and thrift, of accuracy and reliability, and to foster all that makes for right living and good citizenship.

LOCATION.

The Agricultural College is located in Logan, Utah, the county seat of Cache County, which is one of the most prosperous agricultural counties in the state. The city has a population of about 6,000; it is noted for its freedom from vice, is quiet, orderly, clean, and generally attractive, with neat homes, good, substantial public buildings, electric lights, and water system. The citizens are thrifty and progressive. The College is beautifully situated on a broad hill overlooking the city, one mile east of Main street, and commands a view of the entire valley and of its surrounding mountain ranges. The beauty of the location is perhaps unsurpassed by that of any other college in the country. A few hundred yards to the south is the Logan River, with its clear water and luxuriant grasses and shrubs. A mile to the east is a magnificent mountain range and a picturesque canyon. In other directions, the towns and farms covering the green surface of Cache Valley, and seen through the clear atmosphere, constitute a delightful and impressive panorama. The valley is a fertile, slightly uneven plain, 4,500 feet above sea level, about twelve by sixty miles in dimensions, almost entirely under cultivation, and completely surrounded by the Wasatch Mountains, and is one of the most beautiful and healthful valleys in the western region.

BUILDINGS AND GROUNDS.

The College buildings comprise the Main Building, the Experiment Station Building, the Mechanic Arts Building, the Dormitory, the Conservatory, the Veterinary Laboratory, four barns, the Poultry Building, and residences for the President of the College, the Director of the Experiment Station, and the Farm Superintendent, and cottages for farm laborers.

THE MAIN BUILDING is constructed of brick and stone. It

is 360 feet long, 200 feet deep in the central part, and four stories in height. It is heated by steam and lighted by electricity in every part. The rooms are light and pleasant, and the halls spacious, extending on each floor the entire length of the building. This building contains the large auditorium, with a seating capacity of about 1,500; the administrative offices; the library and reading rooms; the gymnasium; the agricultural, zoological, botanical, chemical, and physical laboratories, museums and lecture rooms; the Station chemical laboratories and museum; the office and class rooms of the commercial department; the sewing and millinery rooms; the laundry, kitchen, and dining rooms; the museum and the offices of the department of domestic science; the dairy rooms; the armory and drill hall; the offices and class rooms of the department of civil engineering; and the class rooms for English, mathematics, modern languages and art.

THE EXPERIMENT STATION BUILDING is a brick structure, 45 feet long and 35 feet wide, two stories in height. It contains the laboratory of the Horticulturist; the offices of the Director of the Station, the Agronomist, the Horticulturist, and the Poultry Manager; the mailing rooms; and a dark room for photographic work.

THE MECHANIC ARTS BUILDING, situated just south of the Main Building, is a one-story brick structure, with the exception of the central part, which is two stories high. It has a ground floor area of 16,600 sq. ft., and is divided into four groups of rooms as follows:—for the wood working department—three rooms, with a floor area of 5,956 sq. ft.; for foundry work, forging, and carriage building—four rooms, with a floor space of 6,840 sq. ft.; for machine shop—one room, 2,158 sq. ft.; for draughting room (temporarily used as a testing laboratory), class rooms, office and library—five rooms, with a floor space of 3,376 sq. ft. There are also two store rooms, a coal and coke cellar, and a lockerroom. The second floor—2,500 sq. ft.—is divided into four rooms; viz., Mechanic Arts Museum, blue printing room, room for painting, varnishing and polishing wood work, and class room. The building is heated by steam, well lighted and ventilated throughout, and well equipped for all the work undertaken.

THE DORMITORY is a brick and stone structure, 50 feet wide by 80 feet long, four stories in height. It contains thirty-three rooms for students, each room 12 by 14 feet, exclusive of closet; reception rooms for students; a model kitchen; a dining room; a pantry, supplied with all modern conveniences; bath rooms; and rooms for the matron and for the employees. The rooms of this building are provided with steam heat and electric light, and each room has two registers for ventilation.

THE CONSERVATORY is of the most modern type, 90 by 25 feet, and is filled with beautiful flowering and ornamental plants. There are three compartments of equal size, one for semi-tropical plants, such as ferns, palms, bananas, etc., one for roses, and one for carnations and other plants. The equipment is used to supplement class work in botany, floriculture, and horticulture.

THE VETERINARY HOSPITAL, situated several hundred yards to the rear and east of the Main building, is a stone and frame structure, 18 feet wide and 42 feet long, two stories in height. It contains a well-equipped dispensary, an operating room, stalls, etc.

THE BARNS. There are four barns, for horses, cattle, sheep, and hogs. The *horse barn* is a wooden structure, 60 feet square, and contains model sanitary stables for horses, besides storage divisions for hay, grain, and seed, and rooms for carriages and wagons, farm implements, and machinery; also the farm foreman's room and repair shop. A ten horse-power electric motor furnishes power for grain threshing, feed grinding, and fodder shredding. The *cattle barn* is 106 feet by 104 feet. It is provided with the most modern equipment throughout, including iron stalls, cement floors, mangers, etc. There are accommodations for seventy-five head of cattle; also hospital rooms, feed rooms, a milk room, a root cellar, and storage room for hay and grain. The *sheep barn* is a modern building, 94 feet by 41 feet in dimensions, with accommodations for seventy-five sheep, and storage room for feed. The *hog barn* is a wooden structure, 65 feet by 31 feet. It

contains two feed rooms, a cook room, an abattoir room, and twelve pens, each of which is provided with an outside run. This building accommodates sixty mature animals.

THE POULTRY BUILDING covers 230 feet by 25 feet, with yards 100 feet wide on each side. The building is divided into two sections:—first, the brooder section, with a capacity for about one thousand chicks; second, the experimental section, with a capacity of over five hundred hens. The latter is divided into thirty-two pens; it is shut off from the public and used for conducting experiments on different problems and questions of poultry culture. The building is heated by a hot water system. In the front part are an office, a feed and weigh room, a store room and a sleeping apartment. The basement, 18 by 34 feet, is used only for incubators.

The land occupied by the College and its several departments embraces about 116 acres. Of this, thirty-five acres constitute the CAMPUS, which is tastefully laid out and adorned with flower-beds, and individual specimens and groups of ornamental shrubs and trees, both evergreen and deciduous. There are broad stretches of lawn, and wide drives and walks leading gracefully from various parts of the Campus to the College buildings. During the summer the conservatory contributes its hardy plants for lawn decoration.

Immediately east of the Main Building are the parade grounds and athletic field of about ten acres. The farms comprise 71 acres; the orchards, the forestry, the vineyards, and the small fruit and vegetable gardens, 10 acres. All parts of the College grounds are used by the professors in charge of instruction in agriculture and horticulture for the purpose of practical illustration in their respective departments; they are also used for the work of the Experiment Station.

EQUIPMENT.

The Department of Agronomy is provided with a large collection of agricultural plants and seeds, and other illustrative material. The agricultural laboratory is equipped with balances, a self-registering dynamometer, an appliance for measuring the resistance to tractive force of incline and obstruction, a double-tree hitch apparatus, horse calipers, and apparatus for determining the water-holding capacity of soils, specific gravity of soils, etc. There is also a model of a horse arranged for determining, by experiments, the influence on draft of direction of traces, weight of horse, strength of hock muscles, etc. An apparatus has been provided to demonstrate the influence of head diameter, length and bends on the rate of discharge of water through lines of tile and water pipe. The College farm is equipped with the best farming implements and machinery, including plows, cultivators, planters, cutters, shellers, grinders, a binder, a threshing machine, an electric motor, etc. For illustrative and experimental purposes, the farm is divided into numerous plats, on which different classes and varieties of farm crops are grown.

For the work in Animal Industry, general use is made of the College barns, live-stock, dairy, etc. The live-stock consists of Hereford, Short Horn, Holstein, and Guernsey cattle; Shropshire, Dorset and Rambouillet sheep; and Berkshire, Poland China, Tamworth, Yorkshire hogs. The dairy occupies a floor space of about three thousand square feet, which is divided into seven rooms for the various processes of dairy work. The department is equipped with the apparatus necessary for all the processes of butter and cheese-making and milk-testing. For butter-making there are milk vats and heaters, hand and power separators, hand and power churns, a combined churn and worker, and a Mason butter worker. For cheese-making there are Wisconsin curd test, four vats, gang and upright presses, and a curing room. Ample facilities are provided for illustrating the handling of milk

for the milk trade, including the Star milk cooler, continuous and intermittent pasteurizers, etc. The milk-testing laboratory is as well equipped as any similar laboratory in the country. There are two steam and two hand Babcock testers, and nearly every type of Babcock testing apparatus. There is also apparatus for testing the acidity of milk or cream, and delicate balances, used in testing cheese and butter. The department has an eight horse-power boiler and a six horse-power engine, and model cold storage rooms for butter and cheese. The model poultry house and equipment affords special facilities for illustrative and practical experimental work with poultry.

THE BOTANICAL LABORATORY has a good supply of apparatus with which to do systematic and microscopic work. The herbarium contains 3,000 mounted and named specimens, to which the students have access at all times. There are 700 samples of seeds for use in economic botany. The general equipment includes a compound microscope for each student's use; 15 Bausch and Lomb dissecting microscopes; microtome; hand section cutters; stains; slides; and everything necessary for successful botanical work. The orchard with over 300 varieties of apples, pears, peaches, plums, apricots, and cherries; the vineyard with 60 varieties of grapes, including the hardy and tender, or California kind; the forestry experiment, containing many kinds of hardy trees and shrubs; and the small fruit and vegetable gardens, all are used in connection with the work in botany and horticulture for practical illustrative purposes.

THE VETERINARY LABORATORY is supplied with surgical instruments, a modern operating table, an operating room, box stalls for patients, the necessary medicine, etc. Among the more important surgical instruments are a complete set of dental instruments, mouth speculum, tracheal and roaring instruments, neurotomy set, thermo-cautery, castrating and spaying instruments, obstetrical instruments, postmortem and diagnostic instruments, and other material found in a well-equipped hospital. In this lab-

oratory the agricultural students have practice and observation in the treatment of animals.

The Department of Domestic Science and Arts is located in the Main Building, occupying the first floor of the south wing, besides several rooms in the basement. On the first floor are the office and reception room; a large lecture room; a laboratory and museum, provided with cabinets, charts, and about three hundred specimens showing the composition of food materials and the processes of their manufacture; a room for instruction in home nursing, with proper furnishings to give practice in making and changing beds for the sick and the general care of the sick room; four large sewing rooms, and a fitting room, furnished with the latest improved machines, small sewing tables, low chairs, cutting tables, tracing boards, electric irons, wardrobes and cupboards for holding unfinished work, large display cabinets for finished work, and cabinets containing samples showing the process of manufacturing wool, silk, cotton, and linen. In the basement are two large class kitchens, each containing twelve individual combined work-tables and cupboards, with gas stove on each. The equipment of these rooms includes two large two-oven coal ranges and a single coal range, an Aladdin oven, and an electric stove. There are ample pantries and store rooms, and all necessary utensils and modern conveniences for teaching cooking. The dining room is furnished with extension tables, chairs, sideboards, cupboards, fruit closet, and a generous supply of china, silver, and table linen. The laundry room is provided with stationary tubs, a Chicago clothes-drier, ironing tables, skirt boards, and other necessary furnishings.

The Commercial Department is completely equipped for thorough and efficient work in modern business courses. The entire third floor of the front of the Main Building is occupied by the department, covering a floor area of 7,225 square feet. Each room is specially designed and furnished for the work to be conducted in it. The furniture of the department consists of hard

wood counting room desks and counters, arranged in such a way that students may either sit or stand while at work. A complete set of modern banking fixtures, a wholesale house, a retail house, a commission house, a freight office, a real estate office, and an insurance office, with permanent blank books, letter files, rubber stamps, copying presses, college currency, blanks, etc., are provided by the College. The room for typewriting contains a full complement of standard machines, each provided with stand and copy-holder. The room for stenography is furnished with tables designed for convenience in practice work. The penmanship room and general class rooms are furnished with single desks.

ENGINEERING AND MECHANIC ARTS are taught with the assistance of a large and carefully selected equipment for practical work in shop, field and laboratory. The shops naturally demand the most extensive outfit. The carpentry rooms are supplied with seventy benches, with full sets of tools. The wood-working machinery includes fifteen pattern-maker's lathes, universal saw table, jig and band saws, planer, mortiser and borer, shaper, and sander; and there are the usual clamps, vises, blue-tables, veneer-presses and other special tools required for a shop of this kind. For the work in forging there are provided twenty-three single and eight double forges, each with a complete equipment of anvil and tools. In addition, there are two furnaces, one belted power hammer, drills, special swages, cutting-off machines and leveling tables, with a considerable assortment of special tools. The equipment for foundry work includes iron-melting cupola, brass furnace, core oven, annealing furnaces, flasks, patterns, ladles, crucibles, and full sets of regular tools for flask and floor moulding. The outfit used in carriage building comprises, in addition to the required benches, a full supply of carriage-builders' tools, including hub-boring and boxing machines, spoke-tennoning machine, feloe-boring machine, tire-bender, etc. In the room devoted to machine work in iron are found six large engine lathes, three universal milling machines, a universal grinding machine, two speed lathes, a large radial drill press, a sensitive drill (built by students), two crank shapers, two

large planers, grindstones, and emery wheels; every machine having its regular equipment of tools and attachments. The tool room is well supplied with drills, reamers, cutters of various kinds, files, calipers, etc. The store-rooms contain a full stock of materials to be used in the regular work of the various shops. All machinery, including blast and exhaust systems for the forge shop and foundry, is electrically driven.

The Engineering Laboratory is equipped with modern apparatus for experimental work on the strength and elasticity of all kinds of engineering materials; on efficiency and lost work of machines; on power losses by electrical and mechanical transmission; on the heating value of various kinds of fuels; and on flow of air and gases. The apparatus used for this work is of the highest order, and the results obtained are therefore reliable and of permanent value as engineering data. All junior and senior students are required to become familiar with the operation of this apparatus and to run through a series of tests, all of which are part of a general arrangement by the school to secure complete and reliable data on matters which are modified by local conditions. A fifteen horse-power gasoline engine for power and experimental purposes, a 200,000 lbs. Riehle standard testing machine, a standard cement testing machine, various electric machines, complete electric measuring apparatus, dynamometers, power scales, etc., may be mentioned as important parts of this equipment.

In Civil Engineering, in addition to the laboratory, the interest naturally centers at two points, the apparatus provided for field work, and the equipment of the draughting rooms. For the work in surveying there are four first-class transits, three levels, a Johnson plane table, a planimeter, a clinometer and other supplementary instruments, together with a full supply of chains, tapes, etc. For the work in hydraulics, the equipment includes a number of water meters of different kinds, a hook gauge, water registers, etc. The equipment on the experiment farm in the shape of measuring apparatus, and the many canals, rivers, and power plants in the immediate vicinity, afford excellent opportunity for thorough training in hydraulic work. The draughting rooms are supplied with

draughting tables, special instruments, models, hand books, calculating tables, slide-rules, and such other accessories as are needed for office work.

A recent innovation is the establishment of a special Engineering Library, located in the Mechanic Arts Building. It contains the private library of the professor, with such other books from the general library as may be required for special study. Current engineering literature is placed at the disposal of junior and senior students in Engineering and advanced students in Mechanic Arts. A very extensive list of manufacturers' catalogues has been collected and classified, and forms an important part of this library.

THE BACTERIOLOGICAL LABORATORY is well equipped with modern apparatus for the work offered. Each student is provided with a high-power Leitz or Bausch and Lomb microscope with nose-piece and substage. One microscope with triple nose-piece, fitted with 1-12 and 1-16 oil-immersion objectives, Abbe condenser, and rotary and mechanical stage, is used for identification work. Other equipment includes an autoclay, hot air and steam sterilizers, incubator, refrigerators, aerobic plate apparatus, anaerobic tube apparatus, microtome, analytic balance, cages, permanent mounts, glassware, chemicals, stains and culture media.

THE ZOOLOGICAL LABORATORY is equipped with water and gas, high-power double nose-piece Bausch and Lomb microscopes, dissecting microscopes, condenser, camera lucida, rotary microtome, paraffine bath, freezing apparatus, microspectroscope, photomicrographic camera, hæmacytometer, platinum wire, glassware, reagents, stains, etc. For the work in anatomy and physiology, in addition to the above, there are enlarged models of the eye, ear and brain; and a life-size paper mache manikin; an articulated and a disarticulated human skeleton, and one or more skeletons from each group of the vertebrates. In the work in zoology, the collection of mounted mammals and birds; alcoholic and dry specimens of reptiles, fish and the invertebrates; the Smithsonian material; and living forms from the aquaria are used. For the

work in entomology the exhibition collection of insects, the systematic collection of the department, and the private collection and library of the professor are available.

THE CHEMICAL LABORATORIES occupy the second floor of the north wing of the Main Building, and include ten rooms. One large room is devoted to the work in general chemistry and qualitative analysis, and two smaller rooms to work in organic chemistry and quantitative analysis. A pleasant room, centrally located with respect to laboratories, is used as the lecture room of the department. Adjoining the main laboratory and the lecture room are a large store room and a preparation room for the use of the instructor. On the east side of the wing, two large rooms and a store room are used for the work carried on by the Chemical Department of the Experiment Station. A room in the basement is used for the work in fire assaying.

The chemical laboratories are well equipped for elementary and advanced work in chemistry. In the College laboratories especial provision is made for the elementary study of the science. Individual desks, fitted with drawers and cupboards, and a very complete assortment of chemical glassware and chemicals, render the work in the laboratories easy and pleasant. There are also several valuable collections of gums, oils, coloring matters, foods, etc., that are important aids to the students in this department. The laboratories of the Experiment Station are excellently equipped for advanced work. The extensive collection of apparatus includes, among other things, balances; silver calorimeter; half-shade polariscope; several sets of hydrometers; thermometers; spectroscope; vacuum pan; filter press; apparatus for gas and microchemical analysis; a large supply of platinum ware; several models of elutriators; a very complete set of apparatus for food and fodder analysis; stirring apparatus; steam and hot air drying ovens; microscopes; apparatus for soil analysis; and a large supply of Jena glassware, and chemically pure reagents. The laboratories are fitted with water, gas, hoods and all other conveniences.

THE PHYSICAL LABORATORY occupies a suite of rooms on the second floor. The equipment is fairly complete, consisting of all the necessary pieces of apparatus for class demonstration; a set of apparatus for elementary laboratory work, sufficient for sixteen students working on the same experiment; and all pieces required for an experimental course in heat and electricity. Some of the more important pieces are balances and weights by Sartorius; platform balances; an Atwood machine, with aluminum friction wheels and electrical attachments; centrifugal apparatus; working models of levers and pulleys; air pumps; thermometers in different scales; barometers; hydrometers; hydraulic press; porte lumiere; telescope; microscope; an assortment of lenses, mirrors, and prisms; spectroscope; sonometer; siren; tuning forks; organ pipes; Chladni's plates; electric static machine; Leyden jars; electroscope; electrophorus; magnetometer; galvanometers of tangent, sine, balastic, astatic, and D'Arsonval types; Wheatstone bridges, both box and wire forms; resistance boxes; standard resistance and standard cell; primary and storage cells of various kinds; Ruhmkorff coils; electric generators and motors; Crooke's tubes and Geissler tubes; Toepler-Holtz machine; one complete wireless telegraphy apparatus.

THE COLLEGE MUSEUMS are supplied with a large number of specimens illustrative of geology and paleontology, vertebrate and invertebrate zoology, and mineralogy; also about four thouand five hundred species of the Rocky Mountain flora, and a large number of the woods of the United States. There is also an extensive collection of grains, representing the produce of Utah and other states. Contributions of fossils, ores, animals, relics, or other material of value to the museums will be highly appreciated. All gifts are labeled and preserved, and the name of the donor is kept on record.

THE ART ROOMS contain many valuable casts, most of which are reproductions of the works of the masters, together with many smaller casts suitable for the more simple work of drawing. A

few reproductions of the paintings of the masters are in the equipment, and charts to be used in the work in design; also the tables, drawing boards and cases necessary for the work.

THE LIBRARY, with its offices and reading room, occupies the entire front of the second floor of the Main Building. The large, well-lighted reading room is furnished with tables, comfortable chairs, periodical filing cases, shelves for reference books, and the card cabinet. The books are shelved on the Library Bureau standard steel stacks, arranged in alcoves, where tables are provided for those wishing to do special study. The readers have free access to the shelves.

The library now contains about 15,121 bound volumes and a large number of pamphlets. There have been accessioned since July 1, 1905, 1,747 books; and 1,400 pamphlets have been filed. The books are classified by the Dewey decimal classification, and a dictionary card catalogue of the library is now completed. The shelf list is also on cards, and forms a classed catalogue for official use.

The Library is a designated depository for United States public documents, and receives substantially all documents printed by the government. There are ninety-two periodicals on the subscription list, besides some eighty which are received as exchanges for the publications of the College and the Experiment Station. Thirty-five newspapers of the state are regularly received and placed on file in the reading room.

THE AGRICULTURAL EXPERIMENT STATION.

THE AGRICULTURAL EXPERIMENT STATION is a department of the College, supported by Congressional appropriations, supplemented by the receipts from the sales of farm products, and by such appropriations as the State Legislature makes from time to time to carry out special lines of work, or for the establishment and support of sub-stations. The Station was created for the special purpose of discovering new truths that may be applied in

agriculture, and of making new applications of well-established laws. It is, therefore, essentially a department devoted to research; and as such, it does the most advanced work of the College.

The Experiment Station is not, in the ordinary sense, an institution where model farming is carried on. It has a much higher purpose. The practices of the farmer, good and bad alike, are subjected to scientific tests, in order to determine why the one is bad and the other good. Acting on the suggestions thus obtained, new lines of investigation are begun, with the hope that truths of great value to the farmer may be discovered.

The Station has for its present object the study of the underlying laws of irrigation. On the farm, in the orchards, gardens, and barns, experiments are going on that, in time, will lead to the establishment of an art of irrigation that will be based on laws developed by scientific methods. Special investigations for the purpose of encouraging the horticultural, dairy, and poultry industries, and of reclaiming the alkali and unirrigated lands of the state are also in progress.

By an act of the State Legislature of 1903, five experimental farms have been established in different parts of the state, for the purpose of demonstrating the possibilities of dry or arid farming on the soils of Utah. Another act, passed in 1905, established a central experimental farm, which has been located in Utah county. The work on all these sub-stations, including also the Experimental farm near St. George, in Washington county, is placed under the direction of the Experiment Station. In co-operation with the Department of Agriculture, this Station is carrying on extensive investigations in irrigation, drainage, in sugar beet seed production and in alkali land reclamation.

An annual report and four or five bulletins containing the results of the experiments of the station are published annually for free distribution among the people of the state.

The Experiment Station has a high educational value. Nearly all the members of the Station Staff are also members of the College Faculty, and the students, therefore, receive directly, and at first hand, an account of the methods and results of the work

of the Station. On the farm, in the gardens, orchards, barns and laboratories, the students receive training in the application of scientific truths to the practical affairs of men. The opportunities that the Experiment Station offers for advanced work in several branches of science are of great importance. The methods of science have been carried into the operations of every human occupation; and the more fully scientific methods of accuracy, persistence, and adjustment are understood by a man, the greater as a rule will be his success in any walk of life. The scientific method and spirit characterize all the operations of the Station, and none can fail to be benefited by a study of the experiments that go on at all times of the year.

The Station Staff are always glad to assist the advanced students of the institution in any investigation they may wish to undertake.

COLLEGE SOCIETIES.

Seven different societies are maintained by the students of the College—one doing general literary work, four following special lines, one a debating club, and one strictly social in its object. Of these, two are exclusively for women, three are for men, and two are open to both sexes.

The Sorosis Society is the oldest of the College societies now in existence, and is somewhat exclusive in its nature. It is open to women only, and its object is the general literary and social culture of its members. Weekly meetings are held, at which members usually occupy the time, with an occasional lecture from the outside. At least one public entertainment of a literary nature and several social functions are given each year. The society has elegant apartments in the College building, equipped and furnished by the members.

THE AGRICULTURAL COLLEGE DEBATING CLUB is open to all students who are interested in college debating work. Its object is practical training in debate.

THE AGRICULTURAL CLUB is an organization of instructors and students interested in agricultural education. The object of this organization, which dates its existence in the College from November, 1901, is to promote social feeling among its members and to keep in touch with current events in agricultural science. One of the special features of the club work consists of lectures illustrated by stereopticon views. Meetings are held bi-weekly, and occasionally receptions are given during the year.

THE COMMERCIAL CLUB has for its purpose to promote the interests of the Commercial School, to popularize the commercial courses, and to consider matters of interest not encountered in routine work. The club maintains an annual lecture course, given by prominent men throughout the state on topics of special interest to the business man. By social and literary contact, department loyalty is sought to be strengthened. All commercial students are eligible to membership.

THE ENGINEERING SOCIETY is an organization primarily intended to promote the interests of engineering in the College. While the principal effort is directed towards the professional subjects, the society has recently extended its scope to include social advantages as well. Membership is confined to the School of Engineering. Lectures are given by leading engineers of the state.

THE AGRICULTURAL COLLEGE WOMEN'S LEAGUE is an organization of students, instructors, and other ladies connected with the institution. Its object is to promote useful and agreeable relations among the women of the College and to afford an organized social center for united thought and action.

THE MECHANIC ARTS CLUB. The students in Mechanic Arts maintain a club, the chief object of which is to encourage its mem-

bers to keep in touch with current shop and building practice, and to afford a means of closer acquaintance and association during and after their collegiate life. The Club meets fortnightly to hear lectures and discussions by leading artisans. The chief interest is usually supplemented by less formal social features.

ATHLETICS.

THE ATHLETIC ASSOCIATION is organized for the promotion of the general physical culture of the students, and the encouragement of an active spirit in favor of manly sports. To this end not only does the College maintain representative teams in the different sports, but the various schools of the institutions compete with each other, thus offering men of all degrees of physical ability an incentive in the proper care and development of their bodies. The association is sustained with universal interest, and is accomplishing excellent results. It has at its disposal a ten-acre plot of ground east of the College buildings, where tennis courts, a base-ball diamond, and a foot-ball field have been laid out. A quarter-mile running path is built around the foot-ball field. Lockers and baths are provided for those in training. For indoor exercise the gymnasium on the third floor is available, with a complete equipment of wands, dumb-bells, Indian Clubs, etc. Here an opportunity is given the men to take systematic drill in gymnastics under the direction of the instructor. A ten-lap board track has been built for work in track athletics during the winter. The drill hall may also be used for large classes in gymnastics. The men are assisted in their work by an instructor, whose aim is to help them make the most of the exceptional opportunities athletics offer for mental and moral as well as physical development. Those competing on the College teams must first pass a satisfactory physical examination.

THE COLLEGE MAGAZINE.

The students of the College maintain, as the official organ of the College community, a monthly magazine, "Student Life." The scope of the publication is best indicated by the names of its six departments; viz., Literary, Editorial, Student Affairs, Department Notes, Locals, Alumni and Exchanges. The editorial staff and business managers are chosen from the student body, and receive the enthusiastic support of a large number of students, faculty, alumni, and friends.

STUDENTS' EXPENSES.

Tuition is free. Students pay an annual entrance fee of $5. The privileges of the library and museum are free. In the laboratories, workshops, cooking rooms, and in typewriting, students are charged an incidental fee of $1.00 per credit hour.

The fee charged for a certificate of graduation is $2.50; and for a diploma, $5. Students are held responsible for any injury done by them to the College property.

Good board and rooms can be obtained in private houses for from $3 to $4 per week. By renting rooms and boarding themselves, students are able to reduce the cost of room and board to less than $2.50 per week.

THE COLLEGE DORMITORY has accommodation for sixty. The second floor is used exclusively for women, and the third floor for men, there being no communicating passage between the two. The building is equipped throughout with steam heat and electric lights, and each floor has bathroom and toilet accommodations. The cost of room and board, including fuel and light, is from $13 to $15 a month, according to the kind of room used. Students furnish their own bedding; also rug or carpet, if desired. Board is payable in advance every month. The Dormitory discipline corresponds as nearly as possible to that of home life. Boisterous and rude conduct is not allowed. Parents or guardians of students in the Dormitory may receive a monthly report.

Admission and Graduation.

CONDITIONS OF ADMISSION.

Graduates of the district schools, are admitted provisionally without examination to the College Preparatory Course, and to the three-year courses in Agriculture, Domestic Science, and Commerce, and to the Manual Training Courses in Domestic Arts and Mechanic Arts.

Candidates for admission must be at least fifteen years ot age. In all cases, good moral character is a requisite for admission.

Persons eighteen years old or over, not graduated from the district schools, will be admitted to the technical work of the Manual Training courses in Domestic Arts and Mechanic Arts, prior to June, 1908, after which time, students who cannot show either by certificate or examination that they have completed the work of the eighth grade of the district schools will not be admitted to these courses. Until June, 1908, classes in the elementary branches will be maintained in order that the students referred to above may make up the regular entrance requirements.

Students who have completed the College Preparatory Course are admitted without examination to the Engineering courses, and to the General Science Course. They are also admitted without examination to the four-year courses in Agriculture, Domestic Science, and Commerce, being conditioned in the technical work preceding the freshman year in the course taken.

Students who have completed the first two years of the three-

year courses in Agriculture, Domestic Science, or Commerce, are admitted without examination to the regular four-year courses in Agriculture, Domestic Science, or Commerce, respectively. They are also admitted without examination to the Engineering courses, and to the General Science Course, being conditioned in any of the subjects not already completed of the College Preparatory Course.

Those who have completed any of the three-year courses are admitted without examination to the sophomore year in the corresponding courses leading to degrees. Students may transfer from one regular course to another by making up all the technical work not completed of the course to which they transfer. Students will be allowed to substitute technical work of one course for that of another, only by permission of the Faculty.

Other students are admitted to any of the courses leading to degrees, either upon the certificate of accredited schools, or upon satisfactory examination in the subjects of the College Preparatory Course. For a description of these subjects, see "College Preparatory Course" and "Departments of Instruction." By permission of the Faculty, students may be allowed, upon entrance, to substitute work in other courses for Drawing 1, History 2, Carpentry 5, and Forging 4a. Certificates from schools not accredited will be considered as the merits of each case may warrant.

Candidates for admission to advanced standing are required to pass satisfactory examinations in all the work of the preceding years, or to present satisfactory evidence of having completed an equivalent of such work in some other school or college.

SPECIAL STUDENTS.

Persons of mature years, who for satisfactory reasons desire to pursue a special line of study, may be admitted as special students, provided they give evidence of ability to do the work desired. Special students may be allowed to graduate in any of

the courses, on condition that they complete the required work and pass the necessary examinations.

REGISTRATION.

All students register at the beginning of the collegiate year for the work of the whole year. Changes in registration, and credit for work not registered, will be allowed only by special permission of the Council.

CLASSIFICATION.

All regular students are classified as first, second, and third year students in Agriculture, Domestic Science, or Commerce; or as first and second year students in the College Preparatory Course; or as first, second, third, and fourth year students in the Manual Training courses in Mechanic Arts or Domestic Arts; or as freshman, sophomore, junior, and senior students in any of the four-year courses leading to degrees; according to the lowest year in which they have subjects, provided such subjects are equivalent to one-third of all the work taken; otherwise in the next year above.

GRADUATION.

Students who complete the three-year courses in Agriculture, Domestic Science, or Commerce, or the four-year course in Manual Training in Mechanic Arts, or the three-year course in Manual Training in Domestic Arts receive certificates of graduation. The degrees of Bachelor of Science, Bachelor of Science in Agriculture; Bachelor of Science in Domestic Science, Bachelor of Science in Commerce, Bachelor of Science in Civil Engineering, and Bachelor of Science in Mechanical Engineering are con-

ferred upon those who complete the regular four-year courses in General Science, Agriculture, Domestic Science, Commerce, Civil Engineering, and Mechanical Engineering, respectively.

To obtain a degree the student must have been in attendance at least one school year immediately preceding the time when the degree may be conferred. He must have completed all the prescribed work in one of the four-year college schedules. He must have acquired credits for electives according to the grade and number indicated in his schedule. He may be required to pass a satisfactory oral examination on the technical work of his course before a special committee appointed by the president. He must have no grade lower than D in any subject. Four-fifths of all his term grades must be C or better. He must have discharged all college fees.

He must be recommended for graduation by his school faculty and receive the favorable vote of the president and two-thirds of the members of the College Council. Prospective candidates for graduation will be notified not later than April 10th of their eligibility for graduation.

Schools and Courses of Study.

For the purpose of more efficient administration, the College is divided into five schools: The School of Agriculture, the School of Domestic Science and Arts, the School of Commerce, the School of Engineering and Mechanic Arts, and the School of General Science. These schools are not educationally separate, but are interdependent and together form a unit. They offer the following courses: (1) Agricultural Course, four years; (2) Domestic Science Course, four years; (3) Commercial Course, four years; (4) Civil Engineering Course, four years; (5) Mechanical Engineering Course, four years; (6) General Science Course, four years; (7) Agricultural Course, three years; (8) Domestic Science Course, three years; (9) Commercial Course, three years; (10) Manual Training Course in Domestic Arts, three years; (11) Manual Training Course in Mechanic Arts, four years; (12) College Preparatory Course, two years; (13) Special Winter Courses in Agriculture, Domestic Arts, Mechanic Arts, and Commerce.

THE SCHOOL OF AGRICULTURE.

The instruction in Agriculture is divided into the following departments: The Department of Agronomy, the Department of Irrigation and Drainage, the Department of Animal Industry and Dairying, the Department of Horticulture, and the Department of Veterinary Science. The courses of these departments are arranged especially with the view of enabling the student to lay a foundation upon which he can build a successful career as a

farmer, or develop into a specialist in Agronomy, Animal Industry and Dairying, or Horticulture. For the student who expects to return to the farm, a high school course, continuing through three years, has been arranged; and a college course leading to a degree is offered for those who desire to secure positions as farm managers, or as workers in agricultural faculties and in experiment stations. Farming, as commonly conducted in this inter-mountain region, consists of a union of all of the above divisions of the industry, and the three-year course confines itself to laying a foundation that will secure success on these farms; while the longer course enables the student to direct his efforts along the special lines with which he is most concerned.

In the junior and senior years, the student is allowed to specialize in Agronomy, in Irrigation and Drainage, in Animal Industry and Dairying, in Horticulture, or in Veterinary Science. In these years also a list of electives is offered, from which the student is permitted to select, with the consent of the Committee on Agriculture, a list of studies aggregating not less than sixteen hours a week.

Experience has shown that practically all of the students who take this course come from the farm, and it is assumed that they are acquainted with the various manual operations of farm work. The design of the course is, therefore, to teach the sciences that underlie practical agriculture, and sufficient mathematics, English, history, and other supplementary studies to develop the agricultural students to the intellectual level of the educated in other professions.

The general and department libraries enable the student to become acquainted with a wide range of agricultural and related literature, while the laboratories of the College and the Experiment station afford opportunity for training and experience that it would be impossible to get from books. The outline of the course and the description of the studies prescribed will give a fuller understanding of the work offered.

A Winter Course in Agriculture is provided, designed to meet the needs of young men of mature years, who desire to

follow some agricultural pursuit, and who, though feeling the need of more thorough preparation for their work, can devote only the winter season to such preparation. The subjects presented are those about which every one engaged in agricultural pursuits should have a definite knowledge. They embody the underlying principles and the best practice. The class room instruction is supplemented by practice in the live-stock judging room, veterinary hospital, College dairy, agricultural and horticultural laboratories and greenhouses, and by visits of inspection to herds and farms and other places of interest.

THE SCHOOL OF DOMESTIC SCIENCE AND ARTS.

The courses in Domestic Science and Arts have for their object to train and broaden the minds of women, and to enable them to meet more intelligently the home demands of modern life. When woman has learned to apply the principles of science to the problems of daily living, she will realize that housekeeping is an occupation worthy of the best efforts of the brightest minds; and that the broadest courses in science, economics, and ethics can be applied to the betterment of home life. Formerly the higher education of woman led her away from the practical interests of the home. The recent establishment of Domestic Science courses in many leading colleges and universities shows a public demand for education toward home life rather than away from it. The State of Utah wisely established such courses when this College was first organized; and the favor with which the work has been received by the public shows the wisdom of the plans. The Domestic Science Course has been strengthened and improved each year, and better facilities for instruction and study have been generously provided. The four-year course gives the same training in mathematics, in English, and in science as is given in other baccalaureate courses, together with a broader culture in literature and modern languages than is offered in any other. Both in the preliminary work and in the advanced years,

special studies in the various lines of home science are prescribed in logical order and stand as the distinctive features of the course. The three-year course is arranged as preparatory to the advanced years of the degree course, and also graduates with certificates those who are unable to complete the longer course. The Manual Training Course in Domestic Arts is offered for the benefit of those young women who do not wish to take the studies of the regular college years, but desire to devote more time to the subjects of especial interest to women. Such other studies as the student is qualified to pursue may, with the consent of the Faculty, be substituted for those offered in this course.

THE SCHOOL OF COMMERCE.

The purpose of the School of Commerce is to give opportunity for a liberal education with special emphasis upon the commercial phases of life. Persons who complete the Commercial courses should be better prepared to assume leadership and responsibility in business and in the various industries and professions. Two courses are offered: one of three years, leading to a certificate of graduation; the other of four years, leading to the degree of Bachelor of Science in Commerce. Students in the three-year course may emphasize the work in Accounting, receiving a certificate in Accounting, or they may emphasize the work in Stenography and receive a certificate in stenography. Those who have finished the three-year course in Accounting are admitted to the sophomore year as candidates for degrees. The sophomore year is a continuation of the required work, but the work of the junior and senior years is, to a great extent, elective. During the sophomore year each student is expected to arrange his general plan of work for the junior and senior years. He may select as his major some phase of (1) Political Economy, (2) Political Science, or (3) Accounting and Administration. His plan must be approved by the teacher in charge of the work selected and by the director of the School of Commerce, before May 1st of the

sophomore year. When the student's plan has been approved, his work is continued under the supervision of the professor in charge of the work selected.

For those who expect to enter the profession of law, the Commercial courses afford excellent preparation. Students who complete these courses will be prepared for position as teachers in commercial schools and in department schools where courses in commerce are given. The demand for thoroughly qualified teachers along this line of work is greater than the supply, and many desirable positions are open to those prepared to do the required work.

THE SCHOOL OF ENGINEERING AND MECHANIC ARTS.

The School of Engineering and Mechanic Arts at present includes a four-year course in Civil Engineering and a four-year course in Mechanical Engineering, each leading to the degree of B. S.; also a four-year course in Mechanic Arts, leading to a certificate of graduation.

It is recognized that the first essential to an efficient and consistent course in engineering is a thorough fundamental training in the underlying principles of mechanical science, together with ample experience in the accepted methods of applying these principles to practical problems. With this in view, thorough courses in mathematics, physics, and theoretical mechanics constitute the work in the earlier years of the Engineering courses, while the junior and senior years are devoted chiefly to advanced specialization along the two lines of engineering. Problems of local interest, such as irrigation, power development, power transmission, etc., are made paramount.

The class room work consists largely of lectures and discussions. Numerous problems are assigned to be reported in detail by each student. In these, the method and order of attack and presentation, rather than numerical results, receive the attention and criticism of the instructor. In the shops and laboratory,

opportunity is given for handling materials both in actual construction work and in testing for physical and mechanical properties; also for making tests on the efficiency of power-generating and transmission apparatus. In the field, practice is afforded in land, railroad, and hydrographic surveying. In all of this work the student is brought into contact with modern methods of manipulation and all results are compared for accuracy with accepted standards. The graphical and analytical methods are used throughout. Besides their practical value, the courses in Engineering have a high disciplinary value, and are especially adapted to develop originality of thought and action.

The course in Mechanical Arts is intended to qualify students as artisans, and the practical work of the shops and draughting room is emphasized. The course admits of a three-fold specialization—in woodcraft, forging, and machine work in metals, with special courses in foundry practice, carriage building, cabinet making, sloyd, etc. In this work are developed correct methods of using tools and doing the mechanic's work neatly, efficiently and with rigid accuracy. Sufficient work is given in English, mathematics, and elementary science to represent a fair high school education. Students electing any branch of the Mechanic Arts Course are required to do at least two years work in that branch. No machine work is given until the student has shown a reasonable efficiency with hand tools. All products of the shop are the property of the department, students being permitted to take away specimens of their work only by special permission.

THE SCHOOL OF GENERAL SCIENCE.

To carry out the work of the several technical schools of the College, an efficient instructing force and a complete modern equipment have been provided in the natural and physical sciences, as well as in mathematics, history, language, etc. This makes it possible to satisfy the growing demand for strong baccalaureate courses affording a broad general education in the earlier years, and admitting of specialization later, when the student has matured his plans. Such courses constitute the work of the School of General Science, and, paralleling the other degree courses of the College, lead to the degree of Bachelor of Science. The natural introduction to this work is the College Preparatory Course in English, mathematics, etc., with an option of physiography and botany or a language instead of shop work. The work of the freshman year is all prescribed, consisting of English, mathematics, physics, chemistry and library work—the solid essentials of the specialist along any line. Those who have begun a language the previous years are advised to continue it through the freshman year, and defer the physics until their sophomore work.

Beyond the freshman year, certain requirements are made, as described on page 60, tending further toward a well-rounded disciplinary training. With these restrictions, the whole field of college work lies open, with the understanding that the student will select some one major subject to which to direct his attention, and will group related courses around this, under the direction of the department in which he specializes. For convenience, the subjects offered have been grouped as below, and the requirement is that above the freshman year, the student shall complete ten hours of his work in his major subject, ten hours in subjects found in the same group, and the remainder as he shall elect. For graduation, seventeen hours are required in the freshman year, and the equivalent of sixteen hours through each of the following years. A subject marked * below cannot become a major in the General Science Course; and as required collateral work, the strictly technical studies are excluded.

Science Group.

Physics.	*Agronomy.
Zoology and Entomology.	*Domestic Science.
Geology and Mineralogy.	Chemistry.
*Animal Industry.	Botany.

Mathematical Group.

Mathematics.	Physics.
Chemistry.	Astronomy.
*Engineering.	

Literary Group.

English.	Languages.
History.	Political Science.
Political Economy.	*Commerce.

In THE COLLEGE PREPARATORY COURSE students are thoroughly drilled in the subjects required for admission to the courses in Engineering and General Science.

AGRICULTURAL COURSE.

This course leads to the Degree of B. S., in Agriculture.

Freshman Year.	1st Term.		2nd Term.
Chemistry 1	5		5
Mathematics 4	5		5
English 6	3		3
Horticulture 2	3	Animal Industry 3	3
	16		16

Sophomore Year.	1st Term.		2nd Term.
Physics 1	3		3
English 7	3		3
German or French 1	3		3
Agricultural Chemistry	3		3
Entomology 2	2		2
Irrigation and Drainage 1	3	Agronomy 2	3
	17		17

Junior Year.	1st Term.		2nd Term.
German or French	3		3
Zoology 2	3		3
Animal Industry 4	3	Agronomy 3	3
Bacteriology 1	3	Botany 3	3
Elective	4		4
	16		16

Senior Year.	1st Term.		2nd Term.
Economics	3		3
Geology	3		3
Engineering 3a	3	Veterinary Science	3
Agronomy 4	3	Horticulture 3	3
Elective	4		4
	16		16

DOMESTIC SCIENCE COURSE.

This course leads to the degree of B. S. in Domestic Science.

Freshman Year.	1st Term.		2nd Term.
English 6	3		3
Drawing 3	2	Botany	3
Chemistry 1	5		5
H. S. 8	5	H. S. 9	5
H. S. 5, 10, 12	2		2
	17		17

Sophomore Year.	1st Term.		2nd Term.
German or French	3		3
Mathematics 4	5		5
Physics 1	3		3
H. S. 11	3	H. S. 12	3
Zoology 2	3		3
	17		17

Junior Year.	1st Term.		2nd Term.
English 7	3		3
German or French	3		3
Chemistry 2	4		4
Bacteriology	3	H. S. 13	3
Elective	3	Elective	3
	16		16

Senior Year.	1st Term.		2nd Term.
H. S. 14	3		3
Geology 2	3		3
Chemistry 4	3		3
Elective	5		5
H. S. 15	2		2
	16		16

COMMERCIAL COURSE.

This course leads to the degree of B. S. in Commerce.

Freshman Year.	1st Term.	2nd Term.
English 6	3	3
Mathematics 3	5	5
Pol. Economy 1	3	3
Pol. Science 2	3	3
Accounting and Adm. 3, or Stenography 2	4	4
	18	18

Sophomore Year.	1st Term.	2nd Term.
Chemistry 1	5	5
Banking and Finance	3	3
German, French, or Spanish	3	3
Mathematics 4	5	5
	16	16

Junior Year.	1st Term.	2nd Term.
English 7	3	3
German, French, or Spanish	3	3
Physics 1	3	3
Electives	7	7
	16	16

Senior Year.	1st Term.		2nd Term.
Trade and Trans. 1	3	Pol. Science 4	3
*Electives	13		13
	16		16

*During the Junior and Senior years, students may elect seven and thirteen hours respectively, but at least five hours of each year must be in the school of Commerce.

CIVIL ENGINEERING COURSE.

This course leads to the degree of B. S. in Civil Engineering.

Freshman Year.	1st Term.		2nd Term.
English 6	3		3
Mathematics 4	5		5
Chemistry 1	3		3
Physics 1	5		5
Engineering 1a	2		2
	18		18

Sophomore Year.	1st Term.		2nd Term.
German or French	3		3
Mathematics 5	5		5
Physics 2	5		5
Engineering 1b	2		2
Engineering 3a	3	Engineering 3b	3
	16		16

Junior Year.	1st Term.		2nd Term.
German or French	3		3
Mathematics 6	3	Engineering 9	3
Engineering 5a	3		3
Engineering 11	4	Engineering 4a	4
Geology 3	2		2
Engineering 15	1		1
	16		16

Senior Year.	1st Term.		2nd Term.
Engineering 4b	5		5
Engineering 10	3	Engineering 8b	2
Engineering 5b	3	Engineering 5d	4
Engineering 5e	2		2
Economics	3		3
	16		16

MECHANICAL ENGINEERING COURSE.

This course leads to the degree of B. S. in Mechanical Engineering.

Freshman Year.	1st Term.		2nd Term.
English 6	3		3
Mathematics 4	5		5
Physics 1	5		5
Chemistry 15	3		3
Engineering 1a	2		2
	18		18

Sophomore Year.	1st Term.		2nd Term.
German or French	3		3
Mathematics 5	5		5
Physics 2	5		5
Engineering 1b	2		2
Engineering 3a	3	Engineering 6a	3
	16		16

Junior Year.	1st Term.		2nd Term.
German or French	3		3
Mathematics 6	3	Engineering 2a	3
Engineering 11	4	Engineering 4a	4
Engineering 5a	3		3
Engineering 6b	2		2
Engineering 15	1		1
	16		16

Senior Year.	1st Term.		2nd Term.
Engineering 4b	5		5
Engineering 2b	2		3
Engineering 7a	3		3
Engineering 8a	3	Engineering 8b	2
Economics	3		3
	16		16

GENERAL SCIENCE COURSE.

This course leads to the degree of B. S.

Freshman Year.	1st Term.	2nd Term.
English 6	3	3
Mathematics 4	5	5
Physics 1	3	3
Chemistry 1	5	5
Library Work	1	1
	17	17

All of the work of the sophomore, junior, and senior years is elective; but students are required to complete two years of work in modern languages, and to take an equivalent of five hours through one year in English, of three hours in economics, and of four and one-half hours in zoology or in zoology and botany. Students who elect a language in the second year of the College Preparatory Course continue the language work in the freshman year, taking physics in the sophomore year. Beyond the freshman year, the student does the equivalent of at least ten hours through one year in some subject which he selects as a major, and an equal amount of closely related collateral work. To obtain a degree, the student must complete an equivalent of seventeen hours' work weekly during the freshman year, and sixteen hours for each of the other three years.

AGRICULTURAL COURSE.

Those who complete this course receive certificates of graduation.

First Year.	1st. Term.		2nd Term.
English 3	4		4
Mathematics 2	5		5
Drawing 1	2		2
Drill	1		1
Agronomy 1	3	Animal Industry 1	3
Botany 1	3	Horticulture 1	3
	18		18

Second Year.	1st Term.		2nd Term.
English 4	2		2
*Mathematics 3	5		5
Zoology 1	2		2
Drill 2	1		1
Carpentry 1	2	Forging 4b	2
Entomology 1	3	Veterinary Science 1	3
Animal Industry 5	3	Poultry Craft	3
	18		18

Third Year.	1st Term.		2nd Term.
*English 5	5		5
History 3	3		3
Chemistry 15	3		3
Irrigation and Drainage 1	3	Agronomy 2	3
Horticulture 2	3	Animal Industry 3	3
	17		17

*Students desiring to specialize in some one line may, upon recommendation of the Agricultural Committee, be allowed to omit either English 5 or Mathematics 3 and take additional work in Agriculture.

DOMESTIC SCIENCE COURSE.

Those who complete this course receive certificates of graduation.

First Year.	1st Term.		2nd Term.
English 3	4		4
English 4	2		2
Mathematics 2	5		5
History 1	3		3
Sewing 5, 6	3		3
Physical Culture	1		1
	18		18

Second Year.	1st Term.		2nd Term.
English 5	5		5
Mathematics 3	5		5
Zoology 1	2		2
History 2	3		3
H. S. 1, Sewing 7, 8	2		2
Physical Culture	1		1
	18		18

Third Year.	1st Term.		2nd Term.
English 6	3		3
Drawing 3	2	Botany 1	3
Chemistry 1	5		5
H. S. 8	5	H. S. 9	5
H. S. 5, 10	2		2
	17		18

COMMERCIAL COURSE.

Those who complete this course receive certificates of graduation.

First Year.	1st Term.	2nd Term.
English 3	4	4
English 4	2	2
Mathematics 2	5	5
History 1	3	3
Acc. & Adm. 1	2	2
Pen. 2 or Typ. 1	1	1
Military Drill	1	1
	18	18

Second Year.	1st Term.	2nd Term.
English 5	5	5
History 6	3	3
Pol. Science 1	3	3
Zoology 1	2	2
*Prod. & Manuf. 1 or Typ. 2	2	2
Acc. & Adm. 2 or Sten. 1	4	4
	19	19

Third Year.	1st Term.	2nd Term.
English 6	3	3
Mathematics 3	5	5
Pol. Economy 1	3	3
Pol. Science 2	3	3
Acc. & Adm. 3 or Sten. 2	4	4
	18	18

*This option is open only to students in Stenography who take Typ. 2.

MANUAL TRAINING COURSE IN DOMESTIC ARTS.

Those who complete this course receive certificates of graduation.

First Year.	1st Term.		2nd Term.
English 3	4		4
Mathematics 2	5		5
H. S. 1, 2, 3	3		3
H. S. 6	3		3
Sewing 1	3	Sewing 2	3
Physical Culture	1		1
	19		19

Second Year.	1st Term.		2nd Term.
English 4	2		2
Drawing 1	2		2
History 2	3		3
Zoology 1	2		2
H. S. 5, 4a	3		3
Sewing 3	3	Sewing 4	3
Physical Culture	1		
	16		16

Third Year.	1st Term.		2nd Term.
English 5	5		5
H. S. 7	3		3
H. S. 4b	2		2
Sewing 5	3	Sewing 6	3
Drawing 3 or Sewing 7	3	Botany	3
	16		16

MANUAL TRAINING COURSE IN MECHANIC ARTS.

Those who complete this course receive certificates of graduation.

First Year.	1st Term.	2nd Term.
English 3	4	4
Mathematics 2	5	5
Drawing 2	2	2
Military Drill	1	1
Shop Work	5	5
	17	17

Second Year.	1st Term.	2nd Term.
English 4	2	2
Mathematics 3	5	5
Technology 1	2	2
Engineering 1a	2	2
Shop Work 5	5	5
Military Drill	1	1
	17	17

Third Year.	1st Term.	2nd Term.
English 5	5	5
Mathematics 4	5	5
Engineering 1c	3	3
Shop Work	5	5
	18	18

Fourth Year.	1st Term.	2nd Term.
Physics 1	3	3
History 3	3	3
Zoology 1	2	2
*Technology 2 or	3	3
†Technology 4	3	3
Shop Work	5	5
	19	19

*Taken by students who specialize in machinery or forging.
†Takenby students who specialize in carpentry.

COLLEGE PREPARATORY COURSE.

First Year.	1st Term.		2nd Term.
English 3	4		4
English 4	2		2
Mathematics 2	5		5
History 1	3		3
Drawing 1	2		2
Military Drill, or Physical Culture	1		1
	17		17

Second Year.	1st Term.		2nd Term.
English 5	5		5
Mathematics 3	5		5
Zoology 1	2		2
History 2	3		3
Carpentry 5, or	2	Forging 4a, or	2
Physiography	3	Botany	3
or * Language	3	or Language	3
Military Drill, or Physical Culture	1		1
	18 or 19		18 or 19

* Students may take German, French or Spanish, receiving a credit of three hours a week. This work must be continued in the freshmen year.

WINTER COURSES.

For the accommodation of persons who can attend school during the winter months only, the following special courses are provided, beginning January 8, 1907. The Agricultural Course will be for four weeks, at the conclusion of which students may enter the regular work in Agriculture beginning with the second term. The Domestic Arts, Mechanic Arts, and Commercial courses will be twelve weeks. The work is elective, the student being allowed, with the approval of the professor in charge, to select the studies desired.

Students who take any of the winter courses may elect such other regular College studies as they are prepared to pursue advantageously.

AGRICULTURE.

	Hours.		Hours.
Soils and Farm Crops	5	Agricultural Chemistry	5
Stock Judging and Management	5	Horticulture	5
Stock Feeding	5	Entomology	5
Dairying Lectures	5	Vet. Science	5
Dairying Practice	5	Irrigation	5
		Poultry Keeping	5

DOMESTIC SCIENCE AND ARTS.

Cooking Lectures	5	Sewing	2
Cooking Practice	2	Dressmaking	2
Hygiene	5	Fancy Work	2

MECHANIC ARTS.

Carpentry A	5	Forging A	5
Carpentry B	5	Forging B	5

COMMERCE.

Bookkeeping	4	Penmanship	2
Business Forms	2	Commercial Law	2

Departments of Instruction.

AGRICULTURE.

Professor Ball.
Professor Northrop.
Professor McLaughlin.
Professor Jardine.
Professor Frederick.
Assistant Professor Caine.
Mr. Bolte.
Mr. ————

AGRONOMY.

1. Soils and Farm Crops. The instruction in this subject is quite general and elementary, but thoroughly practical and is intended to show how a knowledge of the natural sciences may be applied in farm practice. Lectures and recitations are supplemented by practical demonstrations in the laboratory, in the vegetation house and on the farm. Required of all first year students in Agriculture. Three hours a week, during the first term. Three hours credit.*

(a) *Soils.* A study of the origin, formation and classification of soils with reference to their agricultural value. Special attention is given to the peculiar soils of the arid region; the conditions of fertility and the circumstances that influence it; reclamation of arid and alkali lands; and methods by which the original soil fertility may be maintained.

(b) *Farm Crops.* A study of the conditions of germination and growth and the circumstances modifying these conditions; practical methods for increasing the yields of crops; con-

stituents of plants; sources and action of the various elements of plant food; the selection of crops for the arid region; the system of rotation best adapted to this state, taking into consideration the distribution of labor, the production of manure, and the extermination of weeds; summer fallow; and management of meadows and pastures. Students in this course are required to make plans for farms, keeping in view the distribution of labor and the maintenance of soil fertility. Frequent excursions are made to the College farms for noting the habits of growth of different farm crops.

2. Rural Engineering. This course embraces a discussion of the principles relating to the locating, arranging and equipping of farms, and the construction and operation of farm implements and machinery. Required of all students in Agriculture electing Agronomy as a major. Three hours a week during the second term of the sophomore year and of the third year in the Three Year Course.

(a) *Laying Out the Farm.* Principles underlying the selection of the farm, its survey, location of buildings, irrigation ditches, drains, roads, etc., and its division into fields and yards.

(b) *Buildings and Fences.* The arrangement, design, location and cost of farm buildings; fences and gates—their necessity, cost, kinds, and construction; wood for gates and fences—time to cut, conditions favorable to decay, and methods of preservation; discussion of fence laws.

(c) *Farm Machinery.* Attention is given to the tools and machinery of the farm—hoes, spades, plows, harrows, cultivators, rollers, planters, cutters, grinders, mowers, rakes, binders, wagons, etc.; their development, design, construction, draft, efficiency, durability, and care. The department has a large collection of lantern slides which are used in illustrating this subject.

3. Soil Physics. In this course the physical and chemical properties of soil receive attention; different methods of treatment are examined, as well as the influence of those methods upon moisture, texture, fertility and production. Further discussions include: soil texture as affecting capillarity; osmosis and diffu-

sion as affected by cultivation and cropping; determination of the absolute and apparent specific gravity of soils; the rate of percolation of water and of air through soils; the determination of temperature and moisture of various soils under field conditions; the effect of sub-soiling and various methods of tillage upon soil moisture and plant growth; the effect of different crops upon the soil and upon the succeeding crops; the effect of special and general farming upon the productive capacity of soils. Two recitations and one laboratory period per week. Required of all junior students in Agriculture. Three hours a week during the second term.

4. SOILS AND CROPS. The instruction in this course is intended to show how a knowledge of the natural sciences may be applied in farm practice and at the same time be thoroughly practical. Lectures and class recitations are supplemented by demonstrations on the farm and in the laboratory.

(a) *Soils.* A study of the origin, formation and classification of soils with reference to their agricultural value. Special attention is given to the soils of the arid regions; the fertility of the soil and the influences that affect it; the reclamation of alkali lands, and methods by which the fertility of the land may be maintained.

(b) *Farm Crops.* A thorough study of the plant is made, beginning with the seed and following it through a complete cycle, or until it has reproduced itself; special attention is given to the germination of seeds; root development; the way in which a plant takes in its feed; and plant breeding and selection. The work is required of all students in Agriculture during the first term of the senior year.

6. AGRICULTURAL EXPERIMENTATION. In this course students have access to the Experiment Station library, and make a study of the work of experiment stations and experimenters in this and other countries. The students are required to make abstracts of a sufficient number of bulletins, bearing on a selected line of work, to become familiar with their scope and aim. Re-

quired of all students in Agriculture electing Agronomy as a major. One hour a week through the year.

7. RURAL ECONOMICS. Required of all students in Agriculture electing Agronomy as a major. Three hours a week during the year.

(a) *History of Agriculture.* This course covers the general development of the agriculture of those nations which have contributed most to agricultural progress. The development of Roman agriculture is specially emphasized, influencing as it has the agricultural practices of other nations.

(b) *Farm Management.* This course includes a discussion of special and general systems of farming, different systems of rotation, laying out and improving farms, economic bestowal of labor, and the profitable use of machinery.

IRRIGATION AND DRAINAGE.

1. IRRIGATION AND DRAINAGE. (a) *Irrigation.* This course includes the measurement of water, methods of applying water, duty of water, methods of preventing losses of soil moisture, irrigation by pumping, and the effect of irrigation upon plant production.

(b) *Drainage.* A study is made of the requirements of land for drainage, methods of drainage, and the removel of alkali; and suggestions are given for laying out and building different kinds of under-drains. Required of sophomores in Agriculture. Three hours a week during the first term.

2. IRRIGATION AND DRAINAGE. (a) *Irrigation.* This course includes the measurement of water by various methods, methods of dividing water, canal management and construction, the location of laterals, methods of irrigation required by different soils, duty of water studies, the use of pumping machinery, the relation of soil moisture to plant growth, evaporation, seepage, and the building of farmers' reservoirs.

(b) *Drainage.* This course treats of the requirements of land for drainage, problems involved in laying out and putting in

a system of farm drains for the removal of water or alkali or both, draining districts, and drainage law. Elective to seniors in the Agricultural Course. Three hours a week.

3. IRRIGATION AND DRAINAGE. This course is designed to supplement courses 1 and 2, and will consist largely of individual work upon problems in irrigation and drainage. Students completing this course will be prepared to take up irrigation or drainage experimental work similar to that of the Federal Government and State Experiment Stations. Elective to students having taken courses 1 and 2.

ANIMAL INDUSTRY.

1. GENERAL COURSES. In this course a study is made of the qualities of animals as indicated by external form. This work also includes score card practice, students being required to give reasons for their rating. Lectures are given on the breeds of live stock best adapted to Utah conditions; the fundamental laws of breeding; selection of live stock; feeding and management. Required of all first year students in the Three Year Course in Agriculture. Three hours a week during second term. Three hours credit.

2. BREEDING. This course includes a study of the laws of heredity, correlation, reversion, variation, and fecundity, and of the methods of breeding, cross-breeding, in-and-in breeding, and selection. These laws are practically illustrated by their application to the improvement of the live-stock on the farm. Practical work is given in the study of herd books, tabulation of pedigrees, and such other exercises as enable the students to learn the value of a pedigree, and how to keep the records of any breeding herd. The live-stock and poultry on the College farm are available for study and illustration. Elective to seniors in Agriculture. Three hours a week during the first term.

3. BREEDS OF LIVE STOCK. The object of this course is to study the different breeds of horses, cattle, sheep, and swine for

the purpose of learning their qualities, characteristics, and adaptabilities. Required of freshment in Agriculture, and of third year students in the three year course. Three hours a week during the second term.

4. Stock Feeding. This is a study of the principles underlying the profitable feeding of animals; the composition of plants, animals, and animal products. A study is made of the practices from the work of experiment stations in this and other countries. Special attention is devoted to the study of Utah conditions in the handling of live-stock. The hygiene, care, and management necessary to successful feeding are also studied. In connection with this course, the live-stock, farm buildings, and other equipment are available for practice and advanced study. Required of juniors in Agriculture. Three hours a week during the first term.

5. Dairying. Required of all second year students in the Three Year Course in Agriculture. Three hours a week during the first term.

(a) *Milk.* This course includes a thorough study of the methods used in testing, buying, and preserving milk for food or manufacturing purposes. The farm problem of milk production is studied in connection with the management of dairy cows.

(b) *Butter.* Factory and hand methods in butter production, creaming of milk by different methods, handling and ripening cream, churning, salting, working, packing, and marketing are studied. The work of the class room is illustrated and applied in the College dairy.

(c) *Cheese.* The process of Cheddar cheesemaking is emphasized. The principles and practice necessary to make a uniform product and to overcome characteristic difficulties are described and illustrated in the class room and dairy. The methods of manufacture of other kinds of cheese, particularly of such kinds as may be made at the home dairy, are also studied. Students taking this course must provide themselves with white duck suits and caps.

6. Advanced Dairying. This course consists of a study of special dairy products, and of experimental work in handling dairy products. Elective to students who have completed Course 5, and Bacteriology. Three hours a week during the second term.

POULTRY CRAFT.

This course consists of a series of lectures supplemented by practical work with fowls. Each student will go through the actual work of artificial incubation and brooding, crate fattening of fowls and will become thoroughly familiar with the management of a practical modern poultry plant by actual experience in the several operations. Plans and specifications for different types of poultry houses will be prepared and a similar plan of a complete poultry plant is required before the course is completed. The work will be practical rather than theoretical and will cover feeding, breeding, incubating and rearing chicks; dressing, marketing, diseases, etc. The work is required of second year students in the Three Year Course in Agriculture during the second term, and takes the equivalent of one recitation period three afternoons weekly. Certain portions of the work will require the attention of the student several times daily for a short period.

To those wishing to specialize in Poultry Husbandry, opportunity will be given to assist in experimental work. Elective courses in advanced work will be offered the junior and senior years, if a sufficient number of students apply for the work.

VETERINARY SCIENCE.

1. General Course in Veterinary Elements. This course considers briefly elementary anatomy and physiology of domesticated animals, and the common ailments of farm animals. A study is made of the most prevalent contagious diseases, their causes, symptoms, course diagnosis and treatment, besides sanitary measures for their suppression and prevention. The subject is taught by lectures and text books and is illustrated by observa-

tion and practice in the free clinics held weekly. Required of all second year students in the Three Year Course in Agriculture; elective to students of other courses. Three hours a week during the first term of the second year.

2. Comparative Anatomy of the Domesticated Animals and Dissection. The subject is taught by a series of lectures including the study of the bones, articulation muscles, circulatory apparatus, respiratory system, the organs of digestion, the urinary-genital organs, and the organs of special sense. The lectures are supplemented by demonstrations from mounted skeletons, prepared specimens, and charts, This study also comprises a comprehensive course in dissection. Each student will be required to dissect animals or parts as assigned and pass an examination before going to another part. Required of seniors in Agriculture. Elective to specials. Three hours a week during second term.

3. Comparative Physiology of Animals. This course consists of general physiology studied by the comparative method. The general properties of animal cells, their organs, development and growth with special physiology of the various organs and tissues of the animal body compared with the human, and common features pointed out anddiscussed. Three hours a week.

4. Sanitary Science. This course consists of a discussion of the following topics: The great plagues of history; the various causes of disease; the manner in which disease is propagated and spread, including the part played by meat and milk; the influence of soil configuration and climatic conditions; and the effect of environment, including ventilation, lighting, and draining of stables. Preventive measures, including disinfection, vaccination, and quarantine, and the methods of preventing the introduction and suppression of outbreaks of contagious diseases are discussed. Three hours per week during junior year. Elective to those who have completed Course 2.

5. Examination for Soundness. This work includes lectures and practical examinations. The student is made familiar with the method of examination, what to consider as unsoundness, etc. A systematic search for disease, the various conditions likely to be found in each part and the effect they may have on the use of the animal. Three lectures per week. Elective to those having completed Course 2.

6. Obstetrics. This course includes a review of obstetrical anatomy, reproduction, hygiene of pregnant animals, pathology of gestation, normal parturition, dystocia, obstetric operations, accidents of parturition, and diseases of the young animals. The college herd and the surrounding stock breeding community give opportunity for practical work. Elective to seniors in Agriculture and others who have completed Course 2. Three hours during second term.

7. Clinics. A free clinic is held at the Hospital once every week. All students taking any of the Veterinary courses are required to attend and assist in this work. The free examinations and treatment, with a nominal charge for Hospital treatment, give the student ample opportunity to apply the work of the class room in actual practice. There are numerous cases brought in each week from the surrounding rich stock growing country, furnishing the clinic with abundant material for actual practice.

HORTICULTURE.

1. Propagation and Care of Plants. A study of the principles of plant increase, growth and development. In the laboratory, practice is given on such matters as pollination, seedage, grafting, budding, layerage, making of cuttings, etc., also the making and management of hot beds, cold frames and forcing houses, making of spraying mixtures and the general requirements of plants in the garden and under glass are discussed in a simple manner. *The Principles of Plant Culture* by Goff, is used

as a text and guide to an intelligent understanding of the work in hand. Required of first year students in the Three Year Course in Agriculture. Three hours a week during second term.

2. POMOLOGY. (Fruit Growing.) This course deals with the theory and practice of fruit growing. The subject is treated under two heads: The practical side is first considered in relation to selection of site for an orchard, reference being made to the soil, exposure, markets and general climatic conditions; also the planting and laying out of an orchard, profitable varieties, the general care and management, including such subjects as the cultivation, irrigation, pruning, and spraying are taken up. The systematic aspects of the subject will be treated in a series of lectures on the origin and classification of fruits. Practice will be given in the description and identification of all varieties obtainable. Besides the lectures and class room work, students will be given practical demonstrations in orchard and nursery practice, including such trips to leading orchards and nurseries as may be satisfactorily arranged. Reference works: *American Fruit Growing,* Thomas; *Principles of Fruit Growing,* Bailey; *Bush Fruits,* Card. Required of freshmen and of third year students in the Three Year Course in Agriculture. Three hours a week during first term.

3. OLERICULTURE. (Vegetable Gardening.) This course treats of the origin, history and botanical relationships of garden vegetables. A study is also made of the location, requisites of soil, fertilization and general cultivation, the planting, transplanting, rotating, harvesting, storing and marketing of crops. Some instruction will also be given in the forcing of early vegetables. Reference works: *Vegetable Gardening,* Green; *Principles of Vegetable Gardening,* Bailey. Required of seniors in Agriculture. Three hours a week during first term.

4. HANDCRAFT. The object of this course is to give a practical working knowledge of horticultural methods. It is elec-

tive to any student who desires to become familiar with plants and the various processes which the horticulturist makes use of to facilitate his work in the gardens, orchards and green houses. One laboratory period throughout the year.

5. GREENHOUSE MANAGEMENT AND CONSTRUCTION. The purpose of the course is to include the work formerly given under the term Floriculture, such as the propagation and management of greenhouse plants, together with a complete study of vegetable and cut flower forcing and the construction and arrangement of greenhouses. Attention is given to the preparation of soils, propagation, planting, transplanting, trimming, and training of house plants; the treatment given bulbs and other plants used for winter decoration and window boxes, and the care during winter of plants used in borders and beds outside. Reference works: *Nursery Book,* Bailey; *Practical Floriculture,* Henderson; *Greenhouse Management and Greenhouse Construction,* Taft. For juniors in Agriculture who elect Horticulture as a major. Two hours a week during the second term.

6. LANDSCAPE GARDENING. This course will be devoted principally to the home grounds. A study will be made of the principles governing the laying out of walks and drives, making of lawns, planting of shrubbery, designing of beds and borders, in short, everything relating to the ornamentation of the home grounds. Reference: *Principles of Landscape Gardening,* Waugh. Two hours a week during the second term.

7. FORESTRY. The study of trees in relation to soil, environment, altitude, humidity, temperature and winds. Their distribution, means of propagation, the starting of windbrakes, shelter belts and forest plantations and the trees and shrubs of Utah are given attention. Reference works: *Forestry of Minnesota,* Green, and *First Book of Forestry,* Both. Two hours a week during the first term.

8. PLANT BREEDING. This course is elective to Seniors in Agriculture who wish a more thorough knowledge of the principles governing the improvement of plants under cultivation. One hour a week during the first term will be devoted to a careful study of the laws relating to the improvement of plants. One laboratory period each week will also be devoted to practical work on the emasculation and crossing of plants. Reference work: *Plant Breeding,* Bailey. Two hours a week during first term.

9. PLANT EVOLUTION. Following Plant Breeding and as a sequel to it will be given a course dealing with the evolution of plants, particular attention being paid to the origin and domestication of those commonly cultivated. Reference work: *Evolution of our Native Fruits and Survival of the Unlike,* Bailey. Two hours a week during the second term.

10. INVESTIGATION. Senior students in Agriculture who elect Horticulture as a major will be allowed to carry on investigational work along horticultural lines in which they have special interest. This course will require an equivalent to one laboratory period each week, the work being done at the time best suited to the students if compatible to the best interests of the work in hand.

ENTOMOLOGY.

1. ECONOMIC ENTOMOLOGY. This course consists of a series of lectures on the injurious and beneficial insects of the region. Life-histories will be discussed and specimens of all stages studied. Of the injurious species, the character of the injury, methods of prevention, remedies, etc., will be emphasized. The student will become familiar with the use of different kinds of spraying apparatus and the preparation of spraying mixtures and other insecticides. Smith's *Entomology* and Comstock's *Manual* will be used as reference texts. Required of second year students in the Agricultural Course and elective to others. Three recitations a week during the first term. Three hours credit.

2. General Entomology. The work of this course will consist of a careful study of typical examples of each group, collecting, mounting, and classifying in all orders, and the working out of life-histories of injurious species and the application of remedies. Required of sophomores in the Agricultural Course and elective to others. Two hours throughout the year. Omitted in 1906-07.

DOMESTIC SCIENCE AND ARTS.

Professor Cotey.
Assistant Professor Cook.
Miss Fisher.
Miss Vibrans.
Miss Powell.
Miss Smith.
Miss Egbert.

HOUSEHOLD SCIENCE.

1. Laundering. The work consists of practice alternating with lectures. The practice includes plain white washing and removing stains; laundering table linen; clear starching; best methods of doing up fine mull; ironing shirts, cuffs, and collars; washing flannels; and cleaning silks and fine woolen gooas. The lectures treat of the chemistry of the various materials used, and of hard waters and the process of softening them. Soaps, washing fluids, bleaching powders, bluings, and starch are discussed in their scientific and practical relations to laundry work. Required of first year students in the Domestic Science Course, and in the Manual Training Course in Domestic Arts. Four hours a week during the first third of the year.

2. Cooking I. The student receives instruction in selecting different cuts of meats, and in the methods of cooking best

adapted to them. Practice is given in roasting, braizing, and boiling, and in stews and pot roasts; in preparing fowls for cooking, and in making dressings; in boning, larding, and skewering; in making croquets, scallops, etc. Instruction is given in preparing soup stocks, in making cream soups, vegetable soups, and purees. Students are taught to prepare sauces suited to different kinds of meats and to make various meat pies, dumplings for stews, and noodles for soups.

Students taking this course share in the work of serving lunches in the way described in paragraph ten, Cooking V. Required of first year students in the Manual Training Course in Domestic Arts. Five hours a week during the second third of the year.

3. COOKING. II. Instruction is given in the making of various kinds of yeast,—salt rising, wet and dry yeast; white and graham bread, corn bread, Boston brown bread; many varieties of rolls and buns. This work includes lessons in making baking powder and in making a great variety of the breakfast breads in which it is used: biscuits, muffins, gems, Johnny cake, pancakes, and waffles. Part of the term is devoted to plain pastry cooking. Required of first year students in the Manual Training Course in Domestic Arts. Six hours a week during the last third of the year.

4(a) COOKING III. Practice is given in making a variety of layer and loaf cakes, sponges, cream puffs, cookies, jumbles and fancy cakes, plain pastry, puff paste, tarts, patties, etc. The student is also given practice in a great variety of baked, boiled, and steamed puddings, custards, blancmanges, whips, creams, jellies, etc. Instruction is given in laying tables for dinner and lunch parties, and in waiting on tables. A few lessons are given in making taffy and sugar candies with French cream fondant. The work includes instruction in cooking vegetables and serving dinners during the winter months. A "high tea" is prepared in the spring. Required of second year students in the Manual Training Course in Domestic Arts. Five hours a week during the last two-thirds of the year.

4(b) COOKING IV. The work in this year includes a course in plain chafing dish cookery; also a course in hospital diets and sick room cookery. During the year the pupils are required to serve a five-course dinner. The pupils work together, plan the menu, do the marketing, and prepare and serve the best meal they can with a given sum of money. Required of third year students in the Manual Training Course in Domestic Arts. Four hours a week throughout the year.

5. FRUIT WORK. This includes canning by various methods, and making all kinds of preserves and marmalade; different methods of making jellies, and experiments with green and ripe fruits; the making of all kinds of ketchups, spiced fruits, sweet and sour pickles, table sauces and meat relishes; the preparing of fruit juices, cordials and syrups. The latter part of the term's work is a course of lectures on the chemical nature of fruit; its acids and sugars; the value of fruit as food, and its action on the human system; the causes of fruit fermentation; and a study of antiseptics. Young women doing this work are required to make use of reference books in the library, and to write essays upon the food value of fruit. Required of third year students in the Domestic Science Course, and in the Manual Training Course in Domestic Arts. Four hours a week during the first third of the year.

6. FOODS. Foods are studied as to their sources, processes of manufacture, conditions in which they are found in the market, and methods of cooking best adapted to each.

A museum of several hundred samples of foods is used to illustrate these lessons.

Talks are given on marketing and the selection of foods, and their care before cooking. Sanitary conditions of the kitchen and store rooms are discussed. General rules of measuring and mixing food materials and their proper proportions and combinations are taught, along with the best methods of baking and boiling, deep and shallow frying, and carving and serving foods. The principles taught in the class are put into practice by each student in

the kitchen. Required of first year students in the Manual Training Course in Domestic Arts. Five hours a week throughout the year.

7. SANITATION AND HYGIENE. The lectures on these subjects treat of sanitary conditions about the home; dangers from damp and unclean cellars, foul drains and sinks; ventilation, heating and lighting; instructions especially necessary to women on the care of personal health; home nursing, with illustrative lessons on changing beds for the sick. Required of third year students in the Manual Training Course in Domestic Arts. Three hours a week throughout the year.

8. HYGIENE, HOME NURSING, AND FIRST AIDS TO INJURED. These subjects are taught by lectures and enforced by illustrations, with references to such authorities as Park, Wilson, Nightingale, Stoney, Hampton, Shaw, Canfield, and Stockholm. Required of third year students in the Domestic Science Course. Five hours a week during the first term.

9. THEORY OF COOKING. The purpose of this course is to give instruction in the best methods of selecting, preserving, and cooking all common food material. All principles learned in the class room are demonstrated in the kitchen. William's *Chemistry of Cookery*, Richard's *Chemistry of Cooking*, and various bulletins issued by the United States Government are used as texts. Required of third year students in the Domestic Science Course. Five hours a week during the second term.

10. COOKING V. This course includes all kinds of plain and some fancy cooking, and covers in a general way all the subjects with which a housekeeper in moderate circumstances needs to be familiar. Demonstration lessons are given at various times throughout the term, on subjects difficult of treatment in the general practice. A three-course lunch is served daily during the winter months. Members of the class take turns in presiding as

hostess at the table, carving and serving plates, and looking after the needs of the guests; they also take turns in waiting upon the table. The confidence and skill thus acquired are invaluable to them. An individual tea is also served with a given sum of money. Required of third year students in the Domestic Science Course. Four hours a week during the last two-thirds of the year.

11. THE SCIENCE OF NUTRITION. This is a study of foods, their chemical composition, characteristics, and digestibility; the way in which they nourish the body; the effect of age, climate, and occupation on the amount and kind of food required. Books on food by such authors as Yeo, Smith, Sir Henry Thompson, Hutchinson, Green, Atkinson, Youmans, Parks, and Hoy are used for reference. Constant use is made of government bulletins on the composition and digestibility of foods. A full set of charts and bottles illustrating the composition of foods is used as an aid to the study. Required of sophomore students in the Domestic Science Course. Three hours a week during the second term.

12. COOKING VI AND INVALID DIET. Cooking VI covers work in salads, ices, desserts, and fancy breads and includes the serving of an individual dinner for a given sum of money. Two students are allowed $3.50 to provide a six-course dinner for ten persons. They plan the menu, do the marketing, prepare and serve the best dinner they can for the money. The work in *Invalid Dietaries* determines the best food to be given in diseases, with practice in their preparation and serving. The preparation of liquid diet, light diet, and convalescent diet is taught as in hospital training schools. *Invalid Cooking* by Mary Boland; *Food in Health and Disease*, by Yeo; *Dietetics*, by Thompson, and similar works are used as texts. Required of sophomore students in the Domestic Science Course. Six hours a week during the second term.

13. SANITATION. The course embraces a study of the conditions necessary to a healthful home—fresh air, pure water, heat-

ing, lighting, and drainage. *Household Sanitation,* issued by the Collegiate Alumni Association, is used as a text book, together with the *Sanitarian.* Reports of various boards of health are used as reference books. Required of juniors in the Domestic Science Course. Three hours a week during the second term.

14. HOUSEHOLD ECONOMICS. Lectures are given on the convenient arrangement and economical furnishing of rooms; the best methods of doing all kinds of housework, with a view to economy of time and strength; the duties of mistress and servants; the entertainment of guests; and many other subjects of interest to the home-maker. Books by prominent writers on these subjects, and a number of periodicals of special value to students of this class, are found in the library. Required of seniors in the Domestic Science Course. Three hours a week during the second term.

15. ADVANCED COOKING AND DIETETICS. This advanced work in cooking includes a chafing dish course, some lessons in camp cookery, experiments in slow cooking with Aladdin oven, the preparation and serving of an elaborate Thanksgiving or Christmas dinner, with advanced work in dietetics. Required of seniors in the Domestic Science Course. Four hours a week throughout the year.

Additional courses in practical cooking will be arranged for students who wish to devote more time to that subject than is allowed in the regular courses.

SEWING.

1. HAND AND MACHINE MODELS. During the first term of the first year, in the Manual Training Course, the student makes a set of models covering the full course in hand sewing; involving practice in basting, overcasting, backstitching, hemming, felling, gathering and stroking gathers, in making gussets, buttonholes, loops, eyelets, sewing on hooks and eyes, and practice in patching,

darning, blanket stitch, slip stitch, chain stitch, French hem, French seam, etc. Instruction is given in the care and use of various machines, and regular practice in running, hemming, felling, gathering, puffing, tucking, quilting, etc. Talks are given on the position of the body and care of the eyes while sewing, on color, and on the nature and manufacture of materials used. Required of the first year students in the Manual Training Course in Domestic Arts. Ten hours a week during the first term.

2. Plain Sewing. During the second term, drawers, skirt and underwaist are cut and made. The student is taught to cut from patterns made according to the system used throughout the course, and to fit and finish a dress of washable material; also to cut, fit, and finish one shirtwaist. Required of first year students in the Manual Training Course in Domestic Arts. Ten hours a week during the second term.

3. Dressmaking. This course includes draughting from measurements, patterns for waists, skirts, sleeves, etc.; practice in cutting and basting; also cutting, fitting, and finishing a worsted dress and fancy waist. Required of third year students in the Manual Training Course in Domestic Arts. Eleven hours a week during the first term.

4. Designing, Cutting, and Fitting. Instruction is given by talks on grace in design of costume, and harmony of color. Further practice is given in cutting and fitting. Required of third year students in the Manual Training Course in Domestic Arts. Eleven hours a week during the second term.

5 (a). Advanced Dressmaking. Further work done in practical costume making, cutting, basting, fitting, pressing, trimming, and finishing. Draughting, from measurements, patterns for waists, skirts, sleeves, princess gowns, jackets, coats, etc., forms a large part of the work.

5 (b). HISTORY OF COSTUME. This is a study of the covering for the body, how it came into use, materials from which it was made, what each tribe of people wore, and the changes in costume from pre-historic times to the nineteenth century. Required of third year students in the Manual Training Course in Domestic Arts. Ten hours a week during the first term.

6. ART NEEDLE WORK. This consists of hemstitching, drawn work, Kensington embroidery. Required of third year students in the Manual Training Course in Domestic Arts. Ten hours a week during the second term.

7. ART NEEDLE WORK. Roman cut work, jeweled embroidery, Mount Mellick embroidery, and modern lace making. Required of third year students in Manual Training Course in Domestic Arts. Ten hours a week during the first term.

8. HAND STITCHES. During the first part of the year, the student makes a set of models, covering the full course in hand sewing, and involving practice in basting, overhanding, overcasting, back stitching, hemming, felling, gathering and stroking gathers, in making gussets, buttonholes, loops, eyelets, in patching, darning, blanket stitch, slip stitch, blind stitch, herring bone stitch, feather stitch, chain stitch, French hem, French seam, etc. Talks are given on the position of the body and care of the eyes while sewing, on color, and on the nature and manufacture of materials used. Required of first year students in the Domestic Science Course. Five hours a week during the first term.

9. MACHINE WORK. The student is taught the use and care of various machines. Regular practice is given in running, hemming, felling, gathering, puffing, tucking, quilting, etc. Drawers, skirt, and underwaist are cut and made. Required of first year students in the Domestic Science Course. Five hours a week during the second term.

10. MACHINE WORK. The students are taught to adapt and use patterns; to cut, fit, and finish a dress of washable ma-

terial; and to cut, fit, hang, and finish one lined skirt of worsted material. Required of second year students in Domestic Science. Four hours a week during the first twelve weeks of the first term, and six hours a week during the next six weeks.

11. DRESSMAKING. This course includes plain draughting from measurements, practice in cutting and basting, and cutting, fitting, and finishing one fancy waist. Required of second year students in Domestic Science. Six hours a week during the second term.

COMMERCE.

PROFESSOR BEXELL
PROFESSOR ENGLE.
PROFESSOR THOMAS.
PROFESSOR ROBINSON.
MR. JENSEN.
MR. BELL.

POLITICAL ECONOMY.

I. General Courses.

1. ECONOMICS I. Discussion of wealth, nature and requisites of production, diminishing returns from natural agents, labor and its increase, efficiency of production, credit, interest, wages, the industrial manager, prices, rent, socialism, taxation, the national debt, free trade, protection, bimetallism, United States notes, banking, the National Banking System, the labor problem, and co-operation. Bullock's *Economics*. Required in the third year of the Commercial Course. Three hours a week throughout the year.

2. ECONOMICS II. Three main purposes are kept in view in this course: a clear analysis of the mechanism and functions of

industrial society; a fundamental discussion of wealth and monopoly—their origin, uses, and abuses; a dispassionate discussion of economic questions that have become political questions. Much reading and many theses are required. Hadley's *Economics* and the*Ashley Series.* Required of seniors in all College courses except Commerce. Three hours a week throughout the year.

3. SOCIOLOGY. The main topics treated are the subject mattter of sociology, relation of sociology to other subjects, sociology as a science, division of sociology, society regarded as a contract, society as an organism, physical basis of society, association, meaning of association, the social mind, causes of social activity, industrial organization of society, the family, the state, the individual, external description of social development, processes of social development, natural selection in human society. The texts are Gidding's *Principles of Sociology* and Fairbank's *Introduction to Society.* Elective in junior and senior years. Two hours a week throughout the year.

II. Banking and Finance.

1 (a) MONEY. Money as a commodity, coinage, legal tender, gold standard, International Monetary Conferences, Colonial bills of credit, Revolutionary bills of credit, greenbacks, Confederate currency, silver dollars, panic of 1893, present conditions, etc. Required of sophomores in the Commerical Course. Three hours a week during the first half of the first term.

(b) BANKING. Functions of a bank, the clearing house system, early American banks, the Bank War, the Safety Fund Bank, the national bank system, state banks, savings banks, loan and trust companies, present problems, etc. Required of sophomores in the Commercial Course. Three hours a week during the second half of the first term.

2. (a) FUNDING OPERATIONS AND CORPORATION FINANCE. Money funds and credit, obtaining funds by inheritance, ex-

change, sales of commercial credit, long time paper, etc. Funding operations by the United States Treasury, the savings bank, building and loan associations, commercial banks, trust companies, brokers, and insurance companies. The general practice in funding corporations and other large business enterprises. Required of sophomores in the Commercial Course. Three hours a week during the first half of the second term.

(b) THEORY AND PRACTICE IN PUBLIC FINANCE. History of financial systems, theories of public expenditures, various methods and practices of taxation and other sources of income, public credit, relation of our Federal Treasury to our monetary system. Required of sophomores in the Commercial Course. Three hours a week during the second half of the second term.

3. (a) COMMERCIAL ORGANIZATIONS. Business men's associations, manufacturers' associations, commercial clubs, boards of trade, various stock exchanges, clearing houses, etc. The methods of business and extensive influence of these organizations. This course is principally research work to determine best methods of procedure in establishing large business enterprises and manipulating large amounts of stock and capital. Elective. Three hours a week during first third of the year.

(b) TRUSTS AND MONOPOLIES. A general research course in studying the present business and financial practices of monopolies, combinations and trusts, with a view of determining the cause and effect of the evils, and also of the virtues of such organizations. Elective. Three hours a week during second third of the year.

(c) DEPRESSIONS, PANICS AND CRISES. Causes and indications of prosperity and depression, prevention of crises and remedies when they occur, history of crises and depressions in the United States, study of the best methods of business practice in prosperity or depression. Elective. Three hours a week during last third of the year.

4 (a) HISTORY OF FINANCE. A brief survey of financial history to 1865. Study of the inflation period, struggle for resumption of specie payment, the silver problem, the surplus revenue of 1888, the two laws of 1890, the expulsion of gold, the panic of 1893, government loans and tariff of 1894, bond syndicate operations, the present financial situation. Elective. Two hours a week during first half-year.

(b) SECURITIES, INVESTMENT AND SPECULATIONS. A general study of the stock markets of the world, together with present indications in private and public finance. Intended primarily for a final survey of the financial situation. Elective. Two hours a week during second half-year.

5. INSURANCE. An elementary course in theory, practice and history of insurance. A study of the history of risks, the different forms of insurance and annuity companies, policies, premiums, mortality tables, statistics, etc. The mathematical side of the subject is outlined under Accounting 5. Elective to juniors and seniors. Three hours a week during the second term.

III. Production and Manufacture.

1. COMMERCIAL GEOGRAPHY AND MATERIALS OF COMMERCE. The main topics treated are: basis of the work, natural conditions affecting commerce, human control of commerce, transportation and commercial routes. There is a discussion of the leading countries of the world under the following heads: Climate, natural features, distribution of leading products, vegetable food products, vegetable and animal fibres, wood crop, minerals, manufacture, agriculture; distribution, necessities and advantages of freight rates, seaports, railroads, canals; trade tendencies, brief historical summaries, cause for shifting of trade centers, present trade tendencies and new regions now being opened, navigation, ocean routes, and such collateral topics as may be necessary to supplement the work outlined. This course presupposes a fair

knowledge of mathematical and political geography, and a minimum knowledge of general history. Required of all Commercial students in the second year. Two hours a week throughout the year.

2 (a) PRODUCTION AND MANUFACTURE I. This course deals with the comparative and extensive sides of the subject. There is a brief survey of latent commercial possibilities, as follows: surface indications, unexplored regions, probable demands upon the earth through future inventions, possible outcome of inhospitable regions and of desert areas, effect of known latent resources upon the expectations and policies of mankind. Present resources of leading nations are then considered, together with their influence upon trade routes. There follows a discussion of competing economic systems, past and present, and of the relation of social and political development of industrial mechanisms. Elective. Five hours a week until holidays.

(b) PRODUCTION AND MANUFACTURE II. This is the intensive course, concerned with direct and indirect production. There is a careful study of the productive and manufacturing processes through which such representative commodities as wheat, cotton, sugar beets, tobacco and lumber pass in going from the producer to the consumer. The work in indirect production considers cotton and woolen goods, steel, boots and shoes, etc. Elective. To continue from holidays to the end of the year. Five hours a week.

3. ECONOMICS OF MACHINE INDUSTRY. This course includes a brief treatment of the history and development of machinery and a discussion of the economic and social effects of labor-saving invention upon society. The influence of labor-saving machinery upon concentration of capital, and its effects upon the labor of men, women, and children receives careful attention. Among the books consulted are Habson's *Evolution of Capitalization,* Wright's *Industrial History of the United States,* and Ely's *Evolution of Industrial Society.* Elective to juniors and seniors. One term. Three hours a week.

IV. Trade and Transportation.

1. HISTORY OF COMMERCE. The development of commerce in Egypt, Greece, Rome, Florence, Mediaeval Europe, etc., down to and including the commercial nations of modern times. Special attention is given to materials and machinery of commerce, to trade routes, and to the relations between commercial developments and other branches of the history of civilization. Required of senior students in the Commercial Course. Three hours a week during the first term.

2 (a) MERCHANDISING. A practical study of business methods, treatment of retailing, wholesaling, commission business, jobbing, etc.

(b) DOMESTIC TRADE. This course considers self-sustaining and dependent localities and their products, together with the exchange of products, and its causes and results.

(c) TRANSPORTATION AND COMMUNICATION. Railroads, canals, lakes, rivers, oceans, etc. Telegraphs, telephones, cables, wireless telegraphy, mail, etc.

(d) FOREIGN TRADE AND RELATIONS. Our surplus, foreign needs, consular service, expense of marketing, reciprocity, tariffs, etc. Required of candidates for degree in Commerce with Trade and Transportation as major. Elective. Five hours a week throughout the year.

3. THEORY AND PRACTICE IN ADVERTISING. A study of the fundamental principles of modern advertising. Special emphasis will be laid on the peculiarities of composition in newspaper and circular advertising, proof-reading, effectiveness of design, illustrations, coloring and display; proper distribution of funds for various forms of advertising, various devices used in so-called "follow up" systems; store and window display, card writing, etc.

Propositions will be submitted to students from local printers and merchants for actual "write ups" during the special advertising seasons. Occasional illustrated lectures will be given. Elective to juniors and seniors. Three hours a week during the second term.

POLITICAL SCIENCE.

1. CIVIL GOVERNMENT. Our European ancestors, origin of states and state institutions, English and American governments compared, state and foreign service, the treasury, money and coinage, banks, the post office, the executive departments, legislation, the constitution, federal and state powers, political parties, party issues, etc. Required of second year students in the Commercial Course. Three hours a week throughout the year.

2. (a) COMMERCIAL LAW. Formation of contracts; dealing with offer and acceptance, form and consideration, capacity of parties, reality of consent, and legality of object. Operation of contracts, including limit of contractual obligations and assignment. Interpretation, rules of evidence, and rules of construction. Discharge of contracts; the agreement, performance, breach, impossibility of performance, and operation of law.

(b) LAWS OF BILLS AND NOTES. Maker's, acceptor's, drawer's and indorser's contracts; proceedings before, upon, and after dishonor; accommodation paper; grantor and surety; holder's position; defense; equities, etc.

(c) CORPORATION LAW. Kinds, formation, powers, liabilities, ownership, shares, subscriptions, calls, notice, transfers, management, officers, directors, contractual powers, dividends, dissolutions, etc.

(d) PARTNERSHIP LAW. Formations of partnership, essentials, liabilities of members, capital, profits, good-will, individual and firm liabilities of members, capital, profits, good will, individ-

ual and firm property, agency for partners, usage, majority, torts of partners, dissolution, winding up, priority, distribution, etc. Required of freshmen in the Commercial Course. Three hours a week throughout the year.

3 (a) CONSTITUTIONAL LAW. The Constitution; the rise of the American Union; distribution and powers of the government; powers of Congress; powers of the Executive; the judicial department; checks and balances of governments; government of the territory; the admission of new states; amendments to the constitution; civil rights and their guarantees; protection of persons accused of crime; protection of contracts and property, etc.

(b) INTERNATIONAL LAW. Persons concerned, rights and duties of states, territorial jurisdiction, jurisdiction on high seas, agents of the state, nationality, treaties, settlement of disputes, war and its effects, military occupation, hostilities, neutrality, contraband, blockade, etc. Elective. Three hours a week during the second term.

4 COMPARATIVE STUDY OF GOVERNMENTS. A comparative study of the various systems of government; Greece, Rome, Great Britain, Germany, France, Switzerland, United States, etc. Required of seniors in the Commercial Course. Three hours a week during the second term.

ACCOUNTING AND ADMINISTRATION.

1. THEORY OF ACCOUNTS. The law of debit and credit, illustrated by correspondence with offices; practice in ruling, checking, construction of balance sheets; practice in letter writing making out bills, invoices, receipts, bills of lading, legal forms, etc. A portion of each period will be devoted to short and rapid methods of commercial calculation. Required of first year students in the Commercial Course. Five hours a week throughout the year. Two hours credit.

2. PRACTICAL ACCOUNTING AND BUSINESS PRACTICE. A thorough and complete course in all the essentials of accounting as practiced in modern business houses. Great stress will be laid on correspondence and the construction of legal and commercial papers. Five budgets must be prepared by each student during each term. A portion of each period will be devoted to rapid calculation. Inter-communication business is carried on between fellow-students and commercial schools in the leading lines of business, affording excellent drill in correspondence and office practice. Given in the second year of the Commercial Course. Two hours daily throughout the year. Four hours credit.

3. ADVANCED ACCOUNTING AND BUSINESS MANAGEMENT.

(a) CORPORATION ACCOUNTING AND AUDITING. A practical application of previous courses in accounting as applied to corporation accounting. Manufacturing, railroading, and merchandising receive special attention.

(b) A thorough study of bank accounting and auditing. Various systems are studied and compared. Office practice and inter-communication work similar to that described under Accounting 2 form a part of this course. The college maintains completely equipped offices in banking, transportation, real estate, brokerage, commission, retailing, and wholesaling. When all the theoretical work and the business practice is completed, the student is placed as manager of one of these offices and is held responsible for all its operations. Each student must pass through at least three offices during the year. Five budgets similar to those described under Accounting 2 are required each term. A portion of each period is devoted to rapid calculations. Given in the third year of the Commercial Course. Two hours daily. Four hours credit.

4 (a) PUBLIC ACCOUNTING AND ADMINISTRATION. A general course in analyzing accounts of various typical corporations in connection with a reference book course along similar lines.

Emphasis is given to such accounts as usually necessitate expert accounting and public auditing.

(b) The organization of individual business, corporations, and bodies politic; detection of waste and fraud; preparation of reports, etc. Elective after Accounting 3. Two hours daily throughout the year. Four hours credit.

5. HIGHER COMMERCIAL MATHEMATICS. Application of the progressions to commercial problems, construction of formulas relating to annuities, sinking funds, the various problems of insurance, theory of probabilities, construction and use of various tables and statistics; the use of logarithms in commercial computation, etc. Elective after Accounting 4. Three hours a week during the first term.

STENOGRAPHY.

1. STENOGRAPHY. This is an elementary course in the Gregg system of Shorthand. The system is adapted perfectly to the hand, the shape of the characters being based upon movements common to ordinary handwriting. Other important features are no position writing, no shading, and no detaching of vowels. These advantages enable the students to master the principles in a short time and to begin work from actual dictation early in the course. The dictation covers business correspondence in various branches. Optional with Accounting 2 to second year students in the Commercial Course. Five hours a week throughout the year. Four hours credit.

2. STENOGRAPHY II. After a thorough review of the text book, various forms of correspondence, legal documents, speeches, specifications, editorial matter, court testimony, etc., are taken up. This course is designed especially for students, with the necessary preparation, who desire to qualify for the United States Civil Service, or for reporting work. A study of public meetings, court procedure, and reporting of public meetings and trials in Logan

and vicinity. Much transcribing on the typewriter. Optional with Accounting 3 to third year Commercial students. Five hours a week throughout the year. Four hours credit.

TYPEWRITING.

1. Typewriting I. Beginning with simple exercises, the student learns correct fingering with other manipulation of the typewriter. Special attention is given to proper care and mechanism of the machine. Optional with Penmanship to first year students in the Commercial Course. One hour a week with much practice between recitations. One hour credit.

2. Typewriting II. This is a special course for those taking Stenography. In addition to the elementary principles given in Typewriting 1, students make copies of correctly written correspondence, legal forms, etc.; also personal composition and dictation. As soon as a moderate speed is attained, the work includes transcription of shorthand notes. One hour daily throughout the year. Two hours credit.

3. Typewriting III. A special course for those who show skill and ability to write rapidly and accurately. Students receive dictation, writing same on the typewriter. Technical typewriting, as used in various branches of business, including tabulating, spacing, etc., is a feature of this course. Elective after Typewriting 1.

PENMANSHIP.

1. This course aims to develop a practical handwriting. Much stress is laid on movement, position of hand and body, etc. Beginning with easy movement drills, the student is led into more difficult exercises, completing with words and short disconnected sentences. Designed for first year students in the Manual Training Courses, and for Winter course students. Daily. Two hours credit.

2. A somewhat advanced course designed especially for Commercial students who have the principles of Course 1 well grounded. Commercial correspondence is made a special feature. Artistic writing, lettering, and engrossing receive attention. One hour credit. Optional with typewriting.

SPECIAL LECTURES.

A series of about ten lectures on practical business subjects will be given during the year by prominent business men throughout the state. All Commercial students are expected to attend these lectures.

ENGINEERING AND MECHANIC ATTS.

PROFESSOR JENSON.
MR. HANSEN.
MR. PULLEY.
MR. WILLIAMS.
MR. WANGSGARD.
MR. THATCHER.
MR. GOFF.
MR. NEWEY.

ENGINEERING.

Note.—The Legislature of the State of Utah at its last session passed a law amending Section 2087 of the Revised Statutes of Utah, 1898, relating to the courses of study that shall be offered by the Agricultural College. This law prohibits the College from offering courses in Engineering; but provides that courses of instruction shall be offered in "elementary surveying," and "in irrigation as applied to the measurement, distribution, and application of water for agricultural purposes."

The Board of Trustees, at a meeting held at the College on July 8, 1905, decided that the institution is under obligation to allow students who have already entered the institution for engineering to continue their courses and graduate upon completion of the work required at the time of entrance.

1a. MECHANICAL DRAWING. This course is intended as a preparation for the work which follows in the courses in Engineering. It consists of a thorough drill in the elementary principles of projection, including linear perspective and the more common conventions of engineering drawing. Required of freshmen in the Engineering courses and of second year students in the Manual Training Course in Mechanic Arts. Prerequisite, Drawing 1, 2 or 3. Six hours a week throughout the year. Two hours credit.

1b. DESCRIPTIVE GEOMETRY. The representation of problems, and the solution of problems relating to geometrical magnitudes in space, including orthographic projections and development; projections of plane and solid intersections; shades and shadows; and applications to stereotomy, sheet-metal work, and other structural problems. Required of sophomores in the Engineering courses. Six hours a week throughout the year. Two hours credit.

1c. DRAWING AND DESIGN. In this course the work is adapted to the line of shop work which the student is pursuing. It is intended to give practice in design with consideration of proper proportion for strength as well as for aesthetic qualities. In this course the student is expected to make his own designs for his work in the shops. Required of third year students in the Manual Training Course in Mechanic Arts who have completed Drawing 5. Nine hours a week throughout the year. Three hours credit.

2a. ELEMENTS OF MECHANISM. This includes a consideration of the various forms of motion and its production; link mo-

tions, and their modifications as used in machinery; cam and wiper outlines; wheel trains and aggregate motions; design and construction of gear teeth; mechanism of special machinery. This subject deals with the purely geometrical relations of machinery, rather than with the form and design of articulating parts. Required of juniors in the Mechanical Engineering Course. Five hours a week during the second term. Three hours credit.

2b. MACHINE DESIGN. In this course are considered the effects of the moving parts of machinery, such as the reciprocating parts of the steam engine, flywheels, governors, etc.; and the general principles of design in machinery, carrying into effect the principles of the course in mechanism combined with those of the course in applied mechanics. The theory of design is supplemented throughout by the practical design of specific parts. Required of seniors in the Mechanical Engineering Course. Two hours a week during the first term; four hours a week during the second term. Three hours credit in second term.

2c. MACHINERY. This course will afford an opportunity to apply the general principles of mechanism and machine design to a more detailed study of a particular type of machinery. The selection of the type to be studied will be left largely to the individual student. The following types are suggested:—a more detailed study of steam machinery in general; locomotive construction; mining machinery; cotton and wool manufacturing machinery, etc. The work will consist of:—(a) prescribed reading; (b) study of catalogues and bulletins of manufacturers; (c) draughting board designs; (d) visits of inspection to such installations as are within reach. Regular hours will be assigned for consultation with the instructor, whose function will be to aid in getting materials for study and to render such criticism and aid as will secure thorough and thoughtful work and reasonable progress. A definite scheme must be submitted and approved at the beginning of the year, and adhered to throughout the course. The course will be arranged according to the time at the disposal

of the student, with ten hours a week throughout the year as a minimum. No student will be admitted to this course who has not completed all the technical work of the regular course in Mechanical Engineering.

3a. ELEMENTARY SURVEYING. The general methods of plane and topographic surveying and the use, care, and adjustments of instruments. The practical work in the field receives particular attention. Raymond's *Plane Surveying*. Required of sophomores in Engineering courses and of seniors in Agriculture. Six hours a week during the first term. Three hours credit.

3b. ADVANCED SURVEYING. This course deals especially with the advanced problems of city, railway, and hydrographic surveying. Raymond's *Plane Surveying* and Searles' or Trautwine's field book. Required of all sophomores in the Civil Engineering Course. Six hours a week during the second term. Three hours credit.

4a. MECHANICS. In this subject are treated the general laws of statics and dynamics as illustrated in the composition and resolution of force, determinations of centers of gravity, moments of inertia, dynamics of a particle and of rigid bodies, friction, mechanics of fluids, wind pressure and graphical statics. Required of juniors in the Engineering courses. Four lectures and three hours laboratory a week during the second term. Four hours credit.

4b. APPLIED MECHANICS. This course includes a discussion of the materials of engineering and their use in engineering structures, the derivation of formulae for stress in members, and a careful comparison with the results of experimental research in the strength of materials. This is followed by a study of stresses and strains in framed structures, analytical and graphical methods being used in all cases. These are illustrated by complete analyses of roof and bridge trusses and modern high-framed

buildings. The subject is concluded with the discussions of the continuous girder, the elastic arch, and the general theory of elasticity. Required of seniors in the Engineering courses. Four lectures and three hours laboratory a week throughout the year. Five hours credit.

4c. High Frame Building. This course consists of a complete design of a modern high steel frame building, based upon the theory of stresses in framed structures, and upon modern practice. The instruction will consist of twelve or fifteen lectures, and an equivalent of six hours per week for one-half year in the draughting room. Students who have completed 4b are eligible.

5a. Hydraulics. A thorough study of the general theories of hydraulics, the flow of water through pipes, weirs, orifices and open channels, the measurement of water power, the dynamic pressure of flowing water; together with an introduction to the general theories of water power. Merriman's *Hydraulics*. Required of juniors in the Engineering courses. Three hours a week throughout the year.

5b. Irrigation I. The location, design, construction, and operation of irrigation canals; design and construction of dams, reservoirs, headgates, etc.; the duty of water; subdivision systems, and other subjects relating to irrigation systems. Wilson's *Manual of Irrigation*. Required of seniors in the Civil Engineering Course. Three hours a week during the first term.

5c. Irrigation II. This course deals especially with the problems in irrigation relating to the farm; the measurement and division of water, design of subdivision systems, methods of application of water. Required of seniors in the Agricultural Course who elect Agronomy as a major. Three hours a week during the second term.

5d. Water Supply and Sewage. A detailed study of the questions pertaining to public water supplies, reservoirs, fil-

tration, distribution systems, classes of water pipes, and the design of water supply systems. The course also includes a study of the problems relating to drainage, construction and capacity of sewers, and sewage disposal. Fanning's *Water Supply Engineering*. Required of seniors in the Civil Engineering Course. Four hours a week during the second term.

5e. HYDRAULIC LABORATORY. This course is intended to apply the theoretical work of Courses 5 a, b and d, to practical problems in the measurement of water; establishment of lines and grades for canals, aqueducts, and pipes; rating of meters; making of estimates, etc. Required of seniors in the Civil Engineering Course. Four hours a week throughout the year. Two hours credit.

6a. PATTERN MAKING AND FOUNDRY PRACTICE. This is an elementary course in making patterns of pipe fittings, groove pulleys, hangers, core boxes, etc.; followed by practice in moulding and running simple castings, including some work in core baking, annealing, etc. Required of sophomores in the Mechanical Engineering Course; open to others who have completed Carpentry 5. Ten hours a week during the second term. Three hours credit.

6b. MACHINE WORK. This course consists of selected exercises from Courses 2 and 3 in machine work, Mechanic Arts. Required of juniors in the Mechanical Engineering Course. Six hours a week throughout the year. Two hours credit.

7a. STEAM ENGINEERING. This course begins with a consideration of the elements of a steam power plant, followed by a more detailed study of engines and boilers according to type and adaptability to different services. A careful study is made of the thermodynamics of heat engines, including refrigerating machines. Standard methods of engine and boiler testing, and modern practice in design and construction are also considered. Re-

quired of seniors in the Mechanical Engineering Course. Three hours a week throughout the year.

7b. Heating and Ventilating. This course will consist of a complete design of a modern heating and ventilating plant, according to one of the approved systems. The instruction will consist of three lectures a week for one-half of the year. An equivalent of not less than six hours a week one-half of the year in the draughting room will be required. Students who have completed 7a are eligible.

8a. Power. This course considers the sources of power; prime moves in general and their efficiencies; methods of distribution and transmission, with a careful study of losses due to friction, dissipation, etc.; power measurement, and power absorption by various methods of working machinery; also a careful study of lubricants and their economy as such. In connection with the classroom work, laboratory experiments are made in the performance and efficiency of mechanical apparatus of various kinds, and in the efficiency of fuels, in gas analysis, etc. Tests of heating and power plants are made as opportunity is afforded. Required of seniors in the Mechanical Engineering Course. Three hours a week throughout the first term.

8b. Hydraulic Motors. This course deals with the general theory of hydraulic motors; the efficiency of the various leading types and their adaptability to special purposes; and the installation and operation of hydraulic power plants. Required of seniors in the Engineering courses. Two hours a week through the second term.

9. Roads and Pavements. The location, construction, and maintenance of country roads; the pavement of city streets; materials used and methods of construction. Byrne's *Highway Construction.* Required of juniors in the Civil Engineering Course. Three hours a week during the second term.

10. MASONRY STRUCTURES. This course includes a treatment of the materials used in masonry structures; a discussion of the theories relating to retaining walls, dams, arches, and other masonry structures. Special consideration is given to construction with reinforced concrete. Baker's *Masonry Structures*. Required of seniors in the Civil Engineering Course. Three hours a week during the first term.

11. ELECTRICAL TRANSMISSION OF POWER. This course consists of lectures and assigned readings on the phenomena of the electric circuit, with sufficient study of the production of the commercial current to understand the causes of loss in a transmission line. Required of juniors in the Engineering courses. Three lectures and three laboratory hours a week during the first term. Four hours credit.

15. ENGINEERING CONTRACTS AND SPECIFICATIONS. This course deals with the general forms of contracts for construction. Some decisions of the courts in engineering contract cases will be discussed. Familiarity with proper forms and consistent specifications for material and work will be had by means of "plans, specifications, and contracts," worked out by the students. Required of juniors in Engineering courses. One lecture per week.

MECHANIC ARTS.

I. Technology.

1. Required of all second year students in the Manual Training Course in Mechanic Arts. This course is intended to give the student an understanding of the nature of production and physical properties of the constructive materials with which he has to work. The course consists chiefly of two lectures a week throughout the year. Two hours credit.

2. The aim of this course is to give the student a practical knowledge of the various forms of motion, its production and modifications as used in the class of machinery he expects to handle. Open to fourth year students, in the Manual Training Course in Mechanic Arts, who specialize in Forging or Machine Work.

Three hours a week throughout the year. Three hours credit.

3. In this course consideration is given to plans, specifications and details of wooden buildings. Open to fourth year students, in the Manual Training Course in Mechanic Arts, who specialize in Carpentry. Three hours a week throughout the year. Three hours credit.

II. Carpentry.

1. (a) Rudimentary exercises in sawing, ripping, planing, mortising, dovetailing, and general joinery, and the application of these to simple articles of furniture, furnish the details of this course. Correct methods of using and handling tools are emphasized. Open to first year students in the Manual Training Course in Mechanic Arts. Fifteen hours a week during the first term. Five hours credit.

(b) Sharpening and adjusting carpenter's tools, and saw filing, followed by practice in making panels, doors, and sashes, and in simple cabinet work, constitute the work of this course. Open to first year students in the Manual Training Course in Mechanic Arts. Fifteen hours a week during the second term. Five hours credit.

2. Open to second year students in the Manual Training Course in Mechanic Arts who have completed Course 1 (b). Fifteen hours a week throughout the year. Five hours credit.

(a) Plain cabinet making, concluding with a model carpenter's work bench. First term.

(b) Wood turning and other machine work in wood, and the construction of a standard carpenter's tool chest. Second term.

3. In this course the principles and practice gained in the foregoing courses are applied to frame house building. If possible, practice in building a regular house is given; but when such opportunity cannot be had, special parts, such as a section of wall, including doors and windows, hips and valleys in roofs, etc., are built in the shops. Open to third year students in the Manual

Training Course in Mechanic Arts who have completed Course 1 (b), and preferably Course 2 (a). Fifteen hours a week throughout the year. Five hours credit.

4. In this course the student is allowed to specialize in cabinet making, including carving, fitting and finishing, or in inside finishing of houses, or in special work in stair building. In whichever branch he may specialize, he is required to finish a complete design. Open to fourth year students in the Manual Training Course in Mechanic Arts who have completed Course 2. Fifteen hours a week throughout the year. Five hours credit.

5. This course consists of selected exercises from Courses 1 (a) and 2 (b). Required of all second year students in the College Preparatory Course who intend to take Engineering; also of all second year students in Agriculture. Six hours a week during the first term. Two hours credit.

III. Forging.

1. Open to first year students in the Manual Training Course in Mechanic Arts. Fifteen hours a week throughout the year. Five hours credit.

(a) This course consists of preliminary exercises, such as drawing, bending, twisting, and shaping, followed by exercises in iron welding and making iron tools. Accuracy in methods and results is insisted upon. First term.

(b) The work in this course consists of practice in steel and iron welds, steel and steel welds, and general work in steel tool forging and dressing. Chisels, punches, reamers, hammers, tin shears, nippers, etc., are sample exercises. Second term. Prerequisite, Course 1 (a).

2. Open to second year students in the Manual Training Course in Mechanic Arts who have completed Course 1. Fifteen hours a week throughout the year. Five hours credit.

(a) This course consists of elementary work in horseshoeing and spring building, and in making and repairing different kinds of agricultural and other implements. First term.

(b) The work in this course consists of filing, chipping, hand fitting, polishing, and general vise work; also special forms of forging, such as wicket gates, cultivator teeth, andirons, etc.

3. The work of this course consists of practical carriage building and advanced forging. Open to fourth year students in the Manual Training Course in Mechanic Arts who have completed Course 2. Fifteen hours a week throughout the year. Five hours credit.

4 (a) The work of this course consists of selected exercises from Course 1. Required of second year students in the College Preparatory Course who intend to take Engineering. Six hours a week throughout the second term. Two hours credit.

4 (b) This course consists of selected exercises from Course 1 (a), followed by work in horse-shoeing and in repairing agricultural implements. Required of second year students in the Agricultural Course. Six hours a week during the second term. Two hours credit.

IV. Machine Work.

1. Open to first year students in the Manual Training Course in Mechanic Arts. Fifteen hours a week throughout the year. Five hours credit.

(a) This course consists of special work in chipping, filing, scraping and hand fitting, including work in dressing and tempering machine cutters. First term.

(b) In this course preliminary exercises in straight and taper turning, drilling and planing are given, accompanied by instruction in the care and use of machinery. Second term.

2. Open to second year students, in the Manual Training Course in Mechanic Arts, who have completed Course 1. Fifteen hours a week throughout the year. Five hours credit.

(a) The work of this course consists of exercises in boring and chucking in the lathe, thread cutting, polishing and milling. Shaft couplings, tap wrenches and gear wheels are sample exercises. First term.

(b) This course consists of the manufacture of parts of machinery, such as eccentrics, engine connecting rods, and cranks. Second term.

3. Open to third year students, in the Manual Training Course in Mechanic Arts, who have completed Course 2. Time and credit same as for Courses 1 and 2.

(a) The work of this course is principally that of making mandrels, taps, spiral drills, counter bores and the grinding of hardened parts of machines on the universal grinding machine. First term.

(b) The work of this course affords practice in making fluted reamers, grinding and making milling cutters, special attention being paid to the forms of the cutting edges. Second term.

4. The work in this course is that of actual machine construction; factory methods being emphasized. Speed lathes and sensitive drills may be taken as sample exercises. Open to fourth year students, in the Manual Training Course in Mechanic Arts, who have completed Course 3. Time and credit same as for Courses 1 and 2.

V. Foundry Work.

1. This course consists in thorough practice in moulding and general foundry work, including iron and brass casting. The patterns chosen illustrate a wide range of work, the course being intended to give a general knowledge of foundry practice. Elective. Six hours a week during the first term. Two hours credit.

2. This course will consist of special moulding, especially such work as will be required in connection with the work of machine design. Elective. Six hours a week during the second term. Two hours credit.

VI. Sloyd.

This course in Sloyd is intended primarily for younger students who are not sufficiently developed physically to carry the

heavier work of the regular Mechanic Arts courses. It is also well adapted for teachers who desire to qualify themselves for teaching Sloyd in the district schools. The best Swedish and American methods are followed.

1. (a) Simple household and school-room articles, such as pointers, bread-boards, clothes-horses, foot-stools, scoops, etc., constitute the exercises of this course. Elective. Four hours a week during the first term. Two hours credit.

(b) The work of this course consists of elementary turning and scrolling, simple carving, and the completion of a small cabinet. Elective to students who have completed 1 (a). Four hours a week during the second term. Two hours credit.

CHEMISTRY.

PROFESSOR YODER.
ASSISTANT PROFESSOR STEWART.
MR. PORTER.

1. GENERAL CHEMISTRY. Required of sophomores in the Commercial Course and of freshmen in all other College courses, except Civil and Mechanical Engineering. Nine hours a week throughout the year. Five hours credit.

(a) *Elementary Chemistry.* This course deals with the important facts and fundamental theories of chemistry, and with the application of chemistry in the arts and manufactures. The laws of chemical combination, the writing of reactions, and solving of stoichiometrical problems are given special, careful consideration. Students taking this course must also take Courses 1 (b) and 1 (c).

(b) *Elementary Practical Chemistry.* This course supplements Chemistry 1 (a) and furnishes the necessary practical preparation for qualitative analysis. The non-metallic elements, mainly, are studied with reference to their combinations with each

other; their reactions are verified, and the facts and theories of the lecture room are tested by experiments.

(c) *Qualitative Analysis.* This course runs parallel with and supplements the descriptive study of the metals and their compounds. Under the direction of the instructor, the students apply with their own hands the reagents necessary to determine the composition and properties of chemical compounds. They thus gain a practical knowledge of the methods of chemical analysis and manipulation. Each student is required to analyze and report on a number of unknown substances. This work is deemed extremely important from an educational as well as from a practical point of view.

2. Organic Chemistry. This course consists: (a) of a brief survey of the more important reactions and compounds of the fatty and aromatic series of hydrocarbons and their derivatives, together with a full discussion of the nature and influence of molecular structure; (b) of the preparation of a number of organic compounds to illustrate the methods of work of the organic laboratory. Required of juniors in the Domestic Science Course. Prerequisite: Chemistry 1. Six hours a week throughout the year. Four hours credit.

3. Agricultural Chemistry. This course consists of lectures and assigned readings on the chemical problems of agriculture. The aim is to make the student familiar with our present knowledge of the composition of the plant; the sources of plant food; the composition of the animal; the principles of animal nutrition; and the chemical nature of soils, waters, dairy products, etc. Required of sophomores in the Agricultural Course. Prerequisite: Chemistry 1. Three hours a week throughout the year.

4. Chemistry of Food and Cookery. In this course foods and methods of cooking are studied experimentally, with especial reference to human nutrition. The common foods, both animal and vegetable, are separated by physical and chemical means into their constituents, after which the effects of different

methods of cooking upon the various constituents are investigated. Wine, beer, tea, coffee, milk, and other drinks are also examined and separated into their constituent parts. Spices and condiments are studied with the especial purpose of learning simple methods for the detection of the common adulterants. Some attention is also given to the effect of different kinds of heating apparatus upon the chemical changes that take place during cooking. Required of seniors in the Domestic Science Course; elective to others. Prerequisite: Chemistry 1 and 2. Six hours a week throughout the year. Three hours credit.

5. QUANTITATIVE ANALYSIS. This is mainly a laboratory course, giving the student practice in the typical methods of proximate and ultimate quantitative chemical analysis. It aims also to give, in familiar talks, a due appreciation of the importance of accuracy in chemical work, and of the relation of quantitative analysis to theoretical chemistry. After the necessary introductory practice, samples of water, soils, ores, agricultural products, and foods are analyzed and reported upon. The work of the Experiment Station chemical laboratory furnishes a good opportunity for the study of methods of analysis. Elective to those who have completed Course 1. Credit is given according to the work done.

6. ANALYSIS OF FOODS AND FEEDING STUFFS. In this course, various articles of food, or farm products used for food, are analyzed to determine quantitatively the different constituents, as proteids, carbohydrates, fats, crude fibre, etc. In this work the Methods of Analysis adopted by the Association of Official Agricultural Chemists are in the main followed. Besides this work, numerous exercises in the detection of adulterants are carried out, and, if desired, the sanitary analysis of water will be included. Elective. Prerequisites: Course 1, and preferably Courses 2 and 5. In connection with the work going on in the Experiment Station laboratory, there is excellent opportunity for students to pursue this course. The course is especially valuable to students of

Domestic Science or of Agriculture, by giving them a scientific basis for judging the dietetic value of any food, or for determining a proper ration for man or beast. A direct aim of this course, also, is to fit the students for positions as analysts in agricultural experiment station chemical laboratories, or food inspection laboratories. Credit is given according to the work done.

7. ADVANCED QUALITATIVE ANALYSIS. This is a laboratory course, supplementary to the brief Course 1 (a) in Qualitative Analysis, and is recommended to those General Science students who specialize in Chemistry. Elective. Prerequisite: Chemistry 1. Nine hours a week during the first or second term. Three hours credit.

8. ADVANCED THEORETICAL CHEMISTRY. Lectures and recitations on some of the fundamental laws and theories ot chemistry, including atomic theory, kinetic theory of gases, Avogadro's hypothesis, relation of gaseous, liquid. and solid states, solution pressure and vapor pressure, osmotic pressure, thermo-chemical relations, electrolytic dissociation, chemical equilibrium, law of mass action, isomerism and isomorphism, etc. Elective. Prerequisites: Chemistry 1 and 2. It is desirable to have completed Chemistry 5 also before taking this course. Three hours a week during the first term.

9. HISTORY OF CHEMISTRY. This course, or Chemistry 10, or a combination of these two courses, according to the desires of the students, will follow Chemistry 8 during the second term. Prerequisites as in Chemistry 8. Three hours a week.

10. INDUSTRIAL CHEMISTRY. Lectures and assigned reading on special chemical industries; e. g., the manufacture of sulphuric acid and soda, commercial fertilizers, lime and cements, glass and porcelain, pigments, sugar, starch, alcohol, soap, explosives, etc. It is not proposed in this course to deal exhaustively with many industries, but with a few industries for illustration,

to enable the students to get an idea as to what is required of a chemist or a superintendent of such a factory, and to give him some drill in searching out the best and most profitable methods of conducting any chemical industry. Elective. See Chemistry 8 and 9 for the time and the prerequisites of this course.

11. ASSAYING. The fire and wet methods of assaying continue and supplement the work of Course 5 in quantitative analysis. This course includes a study of the principles of fluxing and their application to typical silicious, barytic, and pyritic ores; the assaying of rich, medium, and low grade silver, gold and lead ores by means of the "nitre," "nail," and "roasting" methods, and the comparison of results; the assaying of copper mattes and bullion by the combined dry and wet methods; and an explanation of mine, mill, and smelter assays. The wet methods of assaying are the ordinary methods of volumetric analysis so modified as to be applicable to the several purposes of the "assay requirements," and will include the rapid determination and estimation of silver, lead, copper, iron, silica, sulphur, zinc, lime, manganese, cobalt, nickel, etc. Large numbers of "smelter checked" samples are given as exercises to the students to assay. The practice in "fire" and "wet" assaying, as given by this course, aims to make of the student a practical and capable assayer. Elective. Prerequisites: Chemistry 1, and preferably Chemistry 5 and 7. A fee of $10 for the year will be charged in this course.

12. PHOTOGRAPHY. A course in practical photography will be offered, consisting principally of practical work by the students, introduced and supplemented by lectures and demonstrations by the instructor. The students will be given the use of a camera, and will expose plates or films under various conditions as to light and subject in and out doors, develop plates and films, study effect of over and under-exposure and over and under-development, print pictures on the several classes of paper, as "blue-print" paper, "printing-out" paper, and "development" paper, tone with gold and with platinum, make transparencies and lantern slides,

and enlarge or reduce pictures. Fees will be charged to cover cost of material consumed. One hour a week during the second term. Elective to students having had one term's work in Chemistry. Students desiring it will be given opportunity for more advanced experimentation along the several phases of photography.

13. RESEARCH WORK. The laboratories of the College and the Experiment Station are open to students with the necessary preparation, who desire to pursue special independent studies in the domain of chemistry. The researches carried on by the chemical department of the Experiment Station are of great aid to students who are engaged in the solution of scientific problems. Elective to those who have completed Courses 2 and 5.

14. INTRODUCTION TO ELEMENTARY CHEMISTRY. This course is organized especially for such as cannot spare the time to take the regular course in elementary chemistry and yet wish to get an introduction to some of the principles of the subject, and gain some familiarity with the more common elements and inorganic compounds. It is required of the third year students in the three-year Course in Agriculture and of freshmen in the Civil and Mechanical Engineering courses. Five hours a week throughout the year. Three hours credit is allowed in the courses in which it is required. No credit is allowed in other College courses.

ZOOLOGY.

PROFESSOR BALL.
ASSISTANT PROFESSOR PETERSON.
MR. RUDOLPH.

1. ELEMENTARY ANATOMY AND PHYSIOLOGY. In this course the structure and function of the different parts of the human

body are carefully considered, special attention being given to the principles that underlie the care of the body. Dietary studies, ventilation, exercise, use of medicines, and other hygienic topics are treated in special lectures. In the laboratory the students first become familiar with the human skeleton and then work out the fundamental unity of the vertebrate plan through a comparison of a series of skeletons. During the second term they take up the microscopic study of tissues and examine fresh material from the butcher's shop. Martin's *Human Body.* Required of all second year students, except in the Manual Training Course in Mechanic Arts, of fourth year students in this course. Two recitations and two hours laboratory a week throughout the year. Two hours credit.

2. GENERAL ZOOLOGY. Required of juniors in the Agricultural Course, of sophomores in the Domestic Science Course and of students in the General Science Course. Two lectures and three hours laboratory a week throughout the year. Three hours credit.

(a) *Invertebrate Zoology.* In each group of the invertebrates a typical example is taken up in detail and from this, as a basis, the related forms are considered and correctly associated. In the laboratory, representative examples of each group are studied and dissected. Special attention is given to Protozoa, *Hydra, Spongilla,* and other fresh water forms. First term. Thompson's *Outlines of Zoology.*

(b) *Vertebrate Zoology.* In this course a detailed study is made of the different groups of the vertebrates, special attention being given to their origin and development. In the laboratory, typical examples of the lower groups are dissected and the remainder of the time is spent in a systematic study of the birds and mammals of Utah. Second term.

3. BIOLOGY. This course includes lectures on distribution of animals, environment, struggle for existence, natural selection, mimicry, protective coloration and resemblance, warning colors,

adaptation, development, degeneration, parasitism, dimorphism, heredity, sex, instinct and reason, and kindred subjects connected with evolution. Jordan and Kellog's *Animal Life* will be used as a reference work. Elective to those who have completed Course 2. Two lectures a week throughout the year. Omitted in 1906-07.

4. ADVANCED PHYSIOLOGY. The subjects discussed are: the phenomena of life; the physiology of the cell; chemical composition of the body; the physiology of nutrition; irritability and contractility; physiology of the circulation; physiology of the nervous system and sense organs. The laboratory work is an introduction to experimental physiology. Elective to those who have completed Course 2, and Chemistry 1. Three hours a week (lectures, conferences, and laboratory work) during the second term.

5. HISTOLOGY. A minute study of the elementary tissues, excepting the nervous system. Some time in the beginning is devoted to the preparation of stains, hardening, fixing and other fluids, each student being required to prepare the reagents for his own use. A typical mammal is used for material. Prepared slides of human tissues are furnished the student. The course includes methods of fixing, decalcifying, staining, imbedding, sectioning, mounting and drawing. Elective to seniors in the Agricultural Course, and to others who have completed Course 2. Three hours a week during the first term.

6. EMBRYOLOGY. In this course the general principles of development are discussed, beginning with the cell, maturation, fertilization, karyokinesis, etc., and taking up the development of the gastrula in the different classes of the vertebrates. In the laboratory the student will trace the development of Ascaris, the frog, chick, and rabbit. Elective to seniors in the Agricultural Course, and to others who have completed Course 2. Three hours a week during the second term.

7. ADVANCED VERTEBRATE ZOOLOGY. In this course the student will take up the comparative anatomy of the higher vertebrates and will become familiar with the classification of the more common forms of the amphibians, reptiles, birds, and mammals of the Intermountain region. One recitation and three hours laboratory a week during the first term. Two hours credit.

BOTANY.

PROFESSOR NORTHROP.

1. ELEMENTARY MORPHOLOGICAL AND HISTOLOGICAL BOTANY. The aim in this course will be to so familiarize the short course student with the purposes and functions of the different organs of the higher plants, that he is thoroughly able to understand the various principles upon which a proper handling of them depends. Microscopes and dissecting instruments are provided, and the course is so arranged that elementary students can easily become sufficiently proficient in this study to enable them to do a much higher grade of work in the succeeding courses offered in the departments of agronomy and horticulture. Required of first year students in the three-year Course in Agriculture. Three hours a week during the first term.

2. MORPHOLOGICAL AND SYSTEMATIC BOTANY. This course is intended to make students familiar with the higher plants and terms used in describing them. The first half of the term is spent in a comparative study of the organs of plants, the succeeding week being devoted to the naming and classifying of the common, native species. An herbarium of fifty mounted and named specimens of these species is required from each student. This course is required of second year College preparatory and first year Domestic Science students and is elective to others. Three hours a week during second term.

3. PLANT HISTOLOGY AND PHYSIOLOGY. A study of plant anatomy, protoplasm, the cell and various tissues, the plant body and the chemical constituents and processes. The functions of growth, such as the absorption of food, movement of water in the plant, respiration, fermentation, changes of color and the effect of gases and changes of temperature, etc., on the life of plants, will also be discussed. All laboratory equipment and materials will be furnished. Bessey's *Essentials in Botany* is used as a text. Required of juniors in Agriculture and elective to others. One lecture and two laboratory periods a week during the second term.

4. PLANT PATHOLOGY. The value of a knowledge of the fungi parasitic on the higher plants is of great importance. For this reason this course is offered as an elective to those having had Courses 1 and 2. The commoner forms of fungi will be studied, thus enabling the student to understand the nature of the organisms which affect the cultivated crops and to apply more intelligently the means for controlling them. Elective to any student who has finished Botany 3 satisfactorily. Two laboratory periods a week during the second term.

GEOLOGY.

PROFESSOR PETERSON.

1. PHYSIOGRAPHY. This course is intended to develop observation, and give an appreciative knowledge of nature's work in and about the earth. The subjects studied will include:—the earth in space, the structure of the earth, land forms, erosions, lakes and lake basins, glaciation, the sea and its work, the atmosphere and the effect of physiographic conditions on the distribution and character of life. An effort will also be made to give each student some knowledge of the common rocks. Gilbert and Brigham's text will form the basis of the work. Optional in the second

year of the College Preparatory Course. Two hours a week throughout the year.

2. General Geology. The instruction given is intended to familiarize the student with the physiographic changes now in progress and the agencies which produce them, with the origin and structure of the various materials composing the earth's crust, and with the chronological succession of the great formations. A careful study of the development of the North American continent from the earliest time will comprise most of the second term's work. Several field trips will be made and enough field practice given to introduce the methods by which the geological phenommena of a given area may be interpreted. Leconte's *Elements of Geology,* fifth edition, will be used as the text book. Required of seniors in the Agricultural and Domestic Science courses; elective to others. Three hours a week throughout the year.

3. Structural Geology. The work in this course will begin with a classification of the common rocks, and a careful study of their characteristics, source and economic value. Work will then be taken up along the lines of structural and topographical geology, with stress laid upon the problems of stratification, cleavage, faulting, disintegration, etc., as it may affect the work of the engineer. Each principle is supplemented by field and laboratory work. Vol. 1 of Chamberlain & Salisbury's *Geology* will form the basis of the work. Required of juniors in the Civil Engineering Course. Two hours a week throughout the year.

4. Economic Geology. The object of this course is to give the student some idea of the mineral resources of the United States. The work will include a careful study of the vein-forming minerals, origin of ore deposits, mining terms and methods, the source, production and economic value of iron, gold, platinum, silver, copper, lead, zinc, mercury, tin, aluminum, etc.; also the sources, with outlines of the processes of preparation, and economic value of coal, petroleum, natural gas, asphaltum, building

stones, cements, soils, clays, mineral fertilizers, mineral water, fuller's earth, lithographic stone, precious stones, etc. Much of the information will be taken from the Reports of the United States Geological Survey. Elective to students who have completed Courses 2 to 5 and Chemistry 1. Two hours a week throughout the year.

5. MINERALOGY. This course is a systematic study of the common minerals as outlined in Dana's Manual. The student is furnished with excellent specimens of all the minerals studied, for both tests and comparisons. The course is essentially individual laboratory work in blow pipe analysis and determinative mineralogy. Elective to those who have completed Chemistry 1. Two hours a week during the year.

PHYSICS.

PROFESSOR PETERSON.

1. ELEMENTARY PHYSICS. The object of this course is to enable every student to obtain a practical acquaintance with laboratory methods of work, and with the elementary facts and laws which are the foundation of the science. The lectures are illustrated by experiments performed by the instructor, and many problems are worked in and out of class. The laboratory work consists of numerous experiments, chiefly quantitative, performed by each student. Carhart and Chute's *High School Physics;* Snyder and Palmer's *One Thousand Problems in Physics.* Required of sophomores in the Domestic Science and Agricultural courses, and of juniors in the Commercial course. Two recitations and one laboratory period each week throughout the year. Three hours credit.

2. ELEMENTARY PHYSICS. This course is designed for freshmen students in the Engineering Course. Much stress is placed upon the fundamental principles of the work, and time

enough is taken to go into the theoretical side of the question as well as to work out concrete problems. Three recitations and two laboratory periods per week. Five hours credit.

3. General Physics. This is a more advanced course than Physics 1. Stress is laid on the subjects of mechanics, heat, and electricity. Carhart's *University Physics*, 2 vols. Required of sophomores in the Engineering courses; elective to others. Four hours a week throughout the year. Three hours credit.

4. Direct Currents and Magnetic Measurements. This course is primarily intended for students specializing in electrical science, but may be taken by others who have the necessary preparation. Most of the work will be in the laboratory, lectures being given from time to time as required. The laboratory work consists of accurate measurements of current strength, resistance, electromotive force, mutual induction, and the magnetic properties of iron. Two hours a week throughout the year.

5. Electromagnetism and Alternating Currents. The methods and aim of this course are similar to those of Course 3. All students in Mechanical Engineering are urged to take Courses 3 and 4 whenever a proper adjustment of their work can be made. Two hours a week throughout the year.

MATHEMATICS AND ASTRONOMY.

Professor Langton.
Assistant Professor Ostien.
Mr. McKay.

Note.—The elective courses in Mathematics are not all given each year, but vary from year to year to suit the convenience of students who desire to specialize in mathematical science. Any elective course not applied for at the beginning of the year by at

least three students properly prepared may not be given. If applied for by the requisite number of students, additional courses in quaternions, determinants, theory of equations, or projective geometry will be given.

1. Arithmetic. This course consists of a thorough treatment of elementary arithmetic. Required of students not graduated from the district schools, who are admitted to the Manual Training Courses. Five hours a week throughout the year. Four sections.

2. Arithmetic and Algebra. Required of second year students in the Manual Training Course in Mechanic Arts, third year students in the Manual Training Courses in Domestic Arts, and first year students in all other courses. Five hours a week throughout the year. Five sections. One section will give special attention to Commercial Arithmetic.

(a) *Advanced Arithmetic.* Special attention is given to the nature, origin, and development of number. The class recitation hour is devoted to thorough consideration of the fundamental processes of arithmetic, including contracted methods of multiplication and division, common and decimal fractions, factors and multiples, mensuration, the metric system of weights and measures, square and cube root, proportion, percentage and interest, and practical problems. First term.

(b) *Algebra.* This course includes a thorough treatment of the fundamental operations, use of parentheses, factoring, highest common factor, lowest common multiple, fractions, and simple equations. Second term.

3. Algebra, Geometry. Required of third year students in the Commercial Course and the Manual Training Course in Mechanic Arts, and of second year students in all other courses, except the Manual Training Course in Domestic Arts. Five hours a week throughout the year. Two sections.

(a) *Higher Algebra.* After a brief review of the subjects treated in Course 2 (b), the following subjects are considered: simple equations, inequalities, involution and evolution, theory of exponents, radicals, quadratic equations, ratio and proportion, progressions, and binomial theorem. *New Complete Algebra*—Wells. First term.

(b) *Plane Geometry.* This course includes the general properties of polygons; problems of construction, and determination of areas; regular polygons and circles, with problems in construction, and methods for determining the ratio of the circumference to the diameter; and maxima and minima. Special attention will be given to the development of the power of logical thinking, and of accuracy and conciseness of expression. *The Essentials of Geometry*—Wells. Second term.

4. Geometry, Algebra, Trigonometry. Required of sophomores in the Agricultural and Domestic Science Courses, of juniors in the Commercial Course, and of freshmen in other courses. Five hours a week throughout the year.

(a) *Solid Geometry.* Wells' *Geometry.* First third of year.

(b) *Advanced Algebra.* This course is a continuation of Course 3 (a), and includes a thorough drill in the most important principles of higher algebra required in the Engineering and other courses. Second third of year.

(c) *Trigonometry.* The deduction of general trigonometric formulae, the solution of plane and spherical triangles, and practice in the use of logarithmic tables. Lyman and Goddard's *Trigonometry.* Last third of year.

5. Analytic Geometry, Calculus. Required of sophomores in the Engineering courses; elective to others who have completed Course 4. Five hours a week throughout the year.

(a) *Analytic Geometry.* The analytic geometry of the straight line, the circle, and the conic sections, including a discussion of the general equations of the second degree, and some special examples in transcendental and higher plane curves.

(b) *Differential Calculus.* The development of the fundamental principles and formulae of the differential calculus; applications to various problems in plane geometry and analysis, such as indeterminate forms, maxima and minima, curvature, expansions of functions in series, evolutes and involutes, and curve tracing.

(c) *Integral Calculus.* Integration of various forms; development of the formulae of the integral calculus; application in rectification of curves, quadrature of plane and curved surfaces, cubature of volumes, etc.

6. DIFFERENTIAL EQUATIONS. This course is arranged to meet the special requirements of engineering students, and includes a treatment of the theory and methods of the solution of total differential equations, with a short introduction to partial differential equation. Required of juniors in the Engineering courses. Three hours a week during the first term.

7. MODERN GEOMETRY. This course treats the most important theorems and examples connected with harmonics, anharmonics, involution, projection (including homology) and reciprocation, including the following: harmonic ranges and pencils; conics and focal projections; anharmonic ratios; homographic ranges; anharmonic properties of points on a conic, of tangents ot a conic; poles and polars; reciprocation; properties of triangles; Pascal's and Brinchon's theorems, homographic ranges on a conic; ranges and pencils in involution; involution of conjugate points and lines; involution range on the conic of a quadrangle and of a quadrilateral; constructions of the first and second degree; the principle of continuity; circular points and lines; real and imaginary projection, generalization by projection; homology. Cremona's *Projective Geometry;* Russell's *Treatise on Pure Geometry;* Lachlan's *Modern Pure Geometry.* Elective to those who have completed Course 5. Five hours a week throughout the year.

8. PLANE AND SOLID ANALYTIC GEOMETRY, ADVANCED COURSE. This course includes the equations and properties of the point, right line, and plane, of the sphere, cylinder and cone, and of the paraboloids, ellipsoids, and hyperboloids the modern algebraical methods of the conic sections; a short discussion of the general theory of higher plane curves and surfaces; applications of the differential and integral calculus to problems involving functions of two or more variables, such as development in series and transformation of functions, curvatures, areas of surfaces, volumes of solids, etc. The work of this course will consist of the discussion of portions of Salmon's *Conic Sections, Higher Plane Curves,* and *Analytic Geometry of Three Dimensions.* Elective to students who have completed Course 5. Five hours a week throughout the year.

9. DIFFERENTIAL AND INTEGRAL CALCULUS, ADVANCED COURSE. This course embraces the elements of the theory of functions of imaginary variables; the various methods of integration, systematically treated; the elements of the theory of the elliptic functions; the mechanical and geometrical applications of the calculus treated more fully than in Course 5; and some of the more important cases of differential equations. Todhunter's *Differential Calculus* and Williamson's *Integral Calculus.* Elective to students who have completed Course 5. Five hours a week throughout the year.

10. HISTORY AND PHILOSOPHY OF MATHEMATICS. This course deals with the origin, development, and logical relation of the various subjects of mathematical science, including a series of synoptic lectures, which may be roughly outlined as follows: mathematics among the ancients; Descartes and the discovery of analytic geometry; Newton, Leibnitz, and the calculus; Hamilton and the invention of quaternions; modern geometry; mathematics and mathematicians of the United States. Ball's *History of Mathematics.* Comte's and Bledsoe's *Philosophy of Mathematics,* the *Encyclopedia Britannica,* and other works of

reference. Elective to students who have completed Course 9. One hour a week throughout the year.

11. GENERAL ASTRONOMY. This course deals with the general facts and principles underlying the science of astronomy, with solutions of many problems, particularly those relating to the determination of latitude, longitude, and time. Instruction is given by means of recitations and lectures. Young's *General Astronomy*. Elective to students who have completed Course 4. Two hours a week throughout the year.

12. PRACTICAL ASTRONOMY. A continuation and completion of Course 11. Theory and use of instruments—sextant, transit instrument, zenith telescope, and equatorial; various methods of determining longitude and latitude; graphical methods of predicting eclipses, etc. Doolittle's *Practical Astronomy;* Clarke's *Geodesy*. Elective to those who have completed Courses 5 and 11. Two hours a week throughout the year.

ENGLISH LANGUAGE AND LITERATURE.

PROFESSOR UPHAM.
ASSISTANT PROFESSOR WYANT.
MR. CAINE.
MISS MOENCH.
MISS HOLMGREN.
MR. JARDINE.

1. GRAMMAR AND COMPOSITION I. This work includes: orthography; the parts of speech; the construction, analysis, and punctuation of easy sentences; the correction of common errors in language; and the writing of brief compositions. The written work is in part suggested by the text book, and in part correlated with the lessons in reading and in geography. Buehler's, *A Modern English Grammar*. Required of students, not graduated from

the district schools, who are admitted to the Manual Training courses. Five hours a week throughout the year. Three sections.

2. Reading and Spelling. In this work there are several ends in view. The pupil is carefully trained to understand and appreciate what he reads, and at the same time particular attention is given to developing a vocabulary and forming a habit of correct expression. Written summaries and reproductions are required and due care is given to spelling. The reading is as follows: Section 1:—Dickens—*Christmas Carol,* Lowell—*Vision of Sir Launfal,* Coleridge—*Ancient Mariner,* Burroughs, Warner and Thoreau—*Essays,* Addison—*Sir Roger de Coverley,* Hawthorne—*Tales of the White Hills,* Stevenson—*Treasure Island,* Cooper—*Last of the Mohicans.* Sections 2 and 3;—Eliot—*Silas Marner,* Guerber—*Myths of Greece and Rome,* Pope—*Homer's Iliad,* Shakespeare—*Merchant of Venice,* Scott—*The Lady of the Lake,* Irving—*Life of Goldsmith,* Lytton—*Last Days of Pompeii.* Required of students, not graduated from the district schools, who are admitted to the Manual Training Course. Five hours a week throughout the year. Four sections.

3. Grammar and Composition *II.* The study of grammar is completed in this course. There is a thorough review of the parts of speech, and attention is given to the principles of syntax, and to the construction and analysis of sentences. Later in the year an elementary text-book in rhetoric is introduced, and the student is drilled in the correct use of words and sentences. Material for composition work is drawn from the text-book, and from the lessons in English Classics and U. S. History. Kimball—*The English Sentence;* Merkley—*A Modern Rhetoric;* Supplementary Reading—Long's *American Poems.* Required of all first year students. Five recitations a week throughout the year. Four hours credit. Six sections.

4. English Classics. Macaulay—*Essay on Johnson,* Milton—*Minor Poems,* Shakespeare—*Julius Caesar,* Tennyson—

Idylls of the King, Scott—*Ivanhoe,* Goldsmith—*Vicar of Wakefield.* This course aims at a thorough understanding of the material, and encourages the student in giving his own expression of the thoughts there found. The elementary qualities of style are explained and illustrated. Occasional written exercises are required, and memory passages are assigned. Required of all first year students, except in the Manual Training Courses, of second year students in these courses. Two hours a week throughout the year. Six sections.

5. RHETORIC AND COMPOSITION. It is intended to make this an extremely practical course in the writing of English. Lectures and recitations, based on an advanced text-book, give continued attention to the principles of rhetoric. The reading of prescribed pieces of prose and poetry, in and out of class, affords contact with the best models. The composition work proper consists of at least three short exercises a week, more or less related to the other work of the course. A longer theme is required each month. These exercises are criticised and returned, and private conferences are given the writers as often as possible. Adams Sherman Hill—*The Principles of Rhetoric;* Milton—*Paradise Lost, Book II;* Macaulay—*Essay on Milton;* Shakespeare—*Macbeth;* Burke—*Conciliation with America.* Required of all second year students except in the Manual Training courses, of third year students in these courses. Five hours a week throughout the year. Three sections.

6. THE HISTORY OF ENGLISH LITERATURE. A general survey of the progress of English literature from the Anglo-Saxon period to the present time. Important movements and significant authors are studied at considerable length, with due attention to social and political relations, and to contemporary foreign literature. The work is carried on by lectures and recitations, a large amount of work being prescribed for reading and discussion. Pancoast's *Introduction to English Literature* is used as a text-book. Required of sophomores in Agriculture and of freshmen

in all other courses. Three hours a week through the year. Two sections.

7. ADVANCED RHETORIC. This course aims to combine various essential features of training in English, for which no opportunity has been previously afforded. During the first half-year, two hours a week are given to the history and principles of literary criticism, and to the forms of prose discourse, placing considerable emphasis on argumentation. One hour each week is devoted to instruction in public speaking, which in the second half-year gives place to practical debating. The recitation work of the second term deals with the English language, being chiefly concerned with the following points:—the history of the language; the development of the literary language from a dialect; the sources of our vocabulary; the processes of change in the meaning of words. Saintsbury—*Loci Critici*. *Specimens of Prose Composition* (four volumes), published by Holt and Co.; Clark and Blanchard—*Practical Public Speaking;* G. P. Baker—*Principles of Argumentation* (Revised Edition); Greenough and Kittredge—*Words and Their Ways in English Speech*. Required of juniors in the Agricultural, Domestic Science and Commercial courses, and of General Science students. Three hours a week throughout the year.

8. THE ELIZABETHAN MOVEMENT. This course offers an opportunity for more advanced work in one particular period of English literature. Beginning with the rise of the Renaissance spirit in England, it will give particular attention to the drama of Shakespeare and his contemporaries, and then follow the decline of the movement to the Closing of the Theatres, 1642. If possible, the Restoration period will be studied in its relation to this movement. Lectures, prescribed reading, and theses. Elective. Two hours a week throughout the year.

9. THE ROMANTIC MOVEMENT. Similar to English 8 in method and requirements. English Romanticism is considered from its reactionary beginnings at the middle of the eighteenth

century to its diffusion among the writers of the Victorian period. Foreign parallel and influences are carefully noted. Elective. Two hours a week throughout the year.

10. CHAUCER AND SHAKESPEARE. This is a course in careful detail study. The first term is devoted to Chaucer's Canterbury Tales, including the Prologue. Matters of grammar, pronunciation, sources, social and political allusions, and literary art, all receive attention. Prominence is given to Chaucer's place in the development of the language. The second term is occupied with the interpretation of four plays of Shakespeare in somewhat the same manner. Three hours a week throughout the year.

11. ANGLO-SAXON AND MIDDLE ENGLISH. This course is designed to furnish a basis for advanced study of the English language, and to acquaint the student with early literature in English. The text-book in Anglo-Saxon is Bright's *Anglo-Saxon Reader;* that in Middle English is Emerson's *Middle English Reader.* Elective. Three hours a week throughout the year.

12 (a) AMERICAN LITERATURE. This course deals with the literary works produced in America from the foundation of the colonies to the present time, particular emphasis being given to the past century. The contemporary development in England is constantly kept in view. Lectures, prescribed reading, and reports. Elective. Three hours a week during the first term. Pancoast—*Introduction to American Literature;* Page—*Chief American Poets.*

(b) VICTORIAN POETS. A course of detailed study for those who have a general knowledge of these poets and wish to consider them at their best. Particular attention is given to Browning and Tennyson. Elective. Three hours a week during the second term.

13. ELOCUTION *I.* This course includes class-room work in voice-culture, gesture, and the principles of expression. The mem-

orizing, interpretation, and delivery of a number of selections are required. Clark and Chamberlain's *Principles of Vocal Expression and Literary Interpretation* is used as a text book. The reading comprises; Arnold's *Sohrab and Rustum;* Rostand's *Cyrano de Bergerac;* Sheridan's *School for Scandal.* Elective to students who have completed English 4.

14. ELOCUTION *II.* The advanced course in Elocution is intended for those who have completed the elementary work and desire to continue under individual instruction. The student may choose between two lines of work. One of these includes a further study of the general laws of expression and the principles of art; the cutting of short stories, novels, and plays for public reading; the interpretation and presentation of more advanced readings. Hauptman's *Sunken Bell,* and Shakespeare's *King Lear* and *As You Like It* will be read. The other line of study is intended to prepare for public speaking. Representative English and American orations will be studied for correct delivery, and effective passages will be analyzed. Original work will be required in the toast, short speech, formal address, and debate. Special study will be made of Shakespeare's *Coriolanus and Julius Caesar.*

MODERN LANGUAGES AND LATIN.

PROFESSOR ARNOLD.

The elementary courses in this department aim to give the student an accurate knowledge of the grammar of the language studied; the ability to translate with readiness from English and into English; and the ability to understand the spoken language and to converse upon simple topics, with proper pronunciation. To attain this end the language studied is as far as possible made the language of the class room; specimens of lyric poetry are committed to memory; much practice is afforded in

prose composition both oral and written; and grammar is studied throughout the course.

The more advanced courses are intended to give the student the ability to read the language without translating, to compose in it and to obtain some speaking facility, as well as to become familiar with some of the classics and scientific works.

NOTE.—Students who intend to study only one language will find it most advantageous to take French if they are following the Domestic Science Course; Spanish, if they are following the Commercial Course; and German, if they are doing work in Agriculture or Engineering.

1. FIRST YEAR FRENCH. Fraser and Squair's *French Grammar, Part I;* Snow and Le Bon's *Easy French,* form the basis of the grammatical work and that in conversation. Three or four modern texts are read, such as Dumas' *Les Trois Mousquetaires;* About's *Le Roi des Montagnes* and Halevy's *L'Abbe Constantin.* Optional with German and Spanish in the Commercial Course and with German in all other courses. Five hours a week throughout the year. Three hours credit.

2. SECOND YEAR FRENCH. Francois' *French Composition* is the basis of a grammatical review and of writing in French. Lavisse's *Histoire de France* is used as subject matter for conversation, while the work in reading consists in translating works of the more important of the nineteenth century authors, such as Hugo, Balzac, Flaubert, Daudet, Anatole France, Maupassant and Loti, with one play of Dumas, fils, one of Augier and one of Pailleron. During the second half year a weekly composition in French is required. Open to those who have completed Course 1 or an equivalent. Three hours a week throughout the year.

3. THIRD YEAR FRENCH. The object of the course is a systematic study of French literature with Doumic's *Histoire de la Literature Francaise* as basis. Weekly compositions in French

will be required, based on outside reading. The class work will be the reading and discussion of as many of the plays of Racine, Corneille and Moliere as possible, with lectures in French by the instructor. The course may be taken with credit two years in succession, as it will alternate with work on the nineteenth century poets. Open to those who have completed Courses 1 and 2 or an equivalent. Three hours a week throughout the year.

4. SCIENTIFIC AND HISTORICAL FRENCH. Translation of monographs on scientific subjects by recent French writers as contained in standard French scientific magazines; sight reading and rapid translation of topics from French writers on history and economics. Open to those who have completed Courses 1 and 2 or an equivalent. Two hours a week throughout the year.

SPANISH.

1. FIRST YEAR SPANISH. Hills's and Ford's *Spanish Grammar;* Matzke's *First Spanish Readings;* Valdes' *Jose;* Alarcon's *El Capitan Veneno.* Optional with French or German in the Commercial Course. Five recitations a week throughout the year. Three hours credit.

2. SECOND YEAR SPANISH. Ford's *Spanish Composition;* Picatoste's *Historia de Espana* as basis for conversation; rapid reading of such modern texts as Valera's *Comendador Mendoza;* Galdos' *Dona Perfecta and Electra;* Breton's *Quien es ella?;* and one classical play. Open to those who have completed Course 1. Optional as Course 1. Three hours a week throughout the year.

GERMAN.

1. FIRST YEAR GERMAN. The first half year Becker's *Elements of German* and the second half Bernhardt's *German Composition* form the basis of the grammatical and written work.

The work in reading begins with Wenkebach's *Glueck Auf*, and is followed by three or four easy texts such as Gerstaecker's *Germelshausen*, Hauff's *Das Kalte Herz*, Heyse's *L'Arrabrata* and Reihl's *Fluch der Schoenheit*. Several poems are memorized. This course is optional with French and Spanish in the Commercial Course and with French in all other College courses. Five recitations throughout the year. Three hours credit.

2. SECOND YEAR GERMAN. Bernhardt's *German Composition* is finished and work in original German composition is begun. Andrea's *Erzaelungen aus der deutschen Geschlichte* is used as basis for conversation and foundation for future understanding of German literature. Many texts are rapidly read, selected from the works of Riehl, Sudermann, Wildenbruch, Freytag, Heine, and other nineteenth century authors, with one scientific text. Three hours a week throughout the year.

3. THIRD YEAR GERMAN. A systematic study of German literature is begun with Keller's *Bilder aus der deutschen Litteratur* as basis. As much as possible of the work of Lessing, Schiller, and Goethe is read and discussed. Open to those who have completed Courses 1 and 2 or an equivalent. Three hours a week throughout the year.

4. SCIENTIFIC GERMAN. The work will consist of rapid reading of scientific texts with the study of cognates, beginning with Walther's *Meereskunde* and Lassar-Cohn's *Chemie im taeglichen Leben*, and followed by monographs by Cohn, Helmholtz, Dubois-Raymond, and other German scientists. Two hours a week throughout the year. Open to those who have completed Courses 1 and 2 or an equivalent.

LATIN.

The following courses in Latin are offered to students in three year courses, and to students in College courses who have not presented parallel courses as entrance requirements.

1. FIRST YEAR LATIN. . Collar and Daniell's *First Year Latin; Viri Romae.* Drill on essentials of Latin grammar; comparison with English grammar, acquiring of vocabulary; English words derived from Latin; selections for reading. Five hours a week throughout the year.

2. SECOND YEAR LATIN. Greenough, D'Ooge and Daniell's *Second Year Latin;* D'Ooge's *Latin Composition based on Caesar;* Bennett's *Latin Grammar;* selected readings from Part 1, *Second Year Latin;* an equivalent of four books from selections from Caesar; oral and written composition. Attention is given to etymology of English derivatives and cognates; accuracy and facility in translation into idiomatic English; sight translation. Open to students who have completed Course 1. Five hours a week throughout the year.

3. THIRD YEAR LATIN. Cicero's Orations:— four against Catiline; Oration in behalf of the Poet Archias; Pompey's Military Command. Advanced composition based on completed passages; study of the life and time of Cicero; sight translation. Open to those who have completed Courses 1 and 2, or an equivalent. Three hours a week throughout the year.

4. FOURTH YEAR LATIN. Virgil's Aeneid; study of meter and versification; vocabulary and grammar of the poet; Virgil's life and friends; comparison of the great epic poems of Homer, Virgil, Dante and Milton; comparison of translations; passages from the Aeneid translated into English in the meter of the original; sight reading; advanced prose composition. Open to those who have completed Courses 1, 2, and 3, or an equivalent. Three hours a week throughout the year.

HISTORY.

PROFESSOR ENGLE.
PROFESSOR THOMAS.

1. GREEK AND ROMAN HISTORY. This course is intended chiefly as an introduction to Greek and Roman history. Thorough text-book work is required. Such reading is done as is necessary to supplement the text. It is the purpose of this work gradually to give the student a broad view of history. In this course the lines of historical study usually followed will be taken up. Greek history occupies the first term, Roman history the second. West's *Ancient World* is the text. Required of first year students in Domestic Science, Commerce, and College Preparatory courses. Three sections, three hours a week throughout the year.

2. UNITED STATES HISTORY. I. This course includes a study of social life, economic conditions, political development, and historical literature. Lectures are occasionally given. Library work is required. The text is Channing's *Student's History*. Required of second year students in the Domestic Science and College Preparatory courses, and second year students in Manual Training in Domestic Arts. Two sections, three hours a week throughout the year.

3. UNITED STATES HISTORY *II*. This course includes the history and interpretation of our national constitution, the relation of our state constitutions to the national government, governmental forms, supreme court decisions as influencing the course of our government; and a careful survey of all those features in American history necessary to intelligent citizenship. Hart's *Actual Government* is the text. Required of second year students in Agriculture, and fourth year students in Mechanics Arts. Three hours a week throughout the year.

4. AMERICAN HISTORY. In this course an attempt is made

to develop the history of North America and of South America as an integral whole. Historical details of individual nations are subordinate to comprehensive views of the relations existing between nations. As far as practicable, the history of North America is organized in relation to United States History, while that of South America is developed in relation to Brazil and Chili. Elective to juniors in the Commercial Course.

5. ENGLISH HISTORY. In this course racial traits, constitutional growth, social life at different stages, English conservatism, colonial systems, and pauperism are some of the topics discussed. A leading aim in the course is to teach the philosophy of history concretely. Research work is an important feature. Elective to those who have completed Course 1. Three hours a week throughout the year.

6. MODERN EUROPEAN HISTORY. This course includes a discussion of European history from Charlemagne to the present time. Among the topics discussed are: the growth of monarchies, the French Revolution, formation of the German Empire, development of the Swiss Confederation, the Napoleonic wars, etc. West's *Modern European History* is the text. Required of second year students in Commerce. Three hours a week throughout the year.

7. PHILOSOPHY OF HISTORY. This course deals with causal relations, fundamental principles, comparative discussions of civilizations, relations of geography and history, historical sources, and appropriate tests of the truthfulness of data. Droysen's *Principles of History*. Elective to those who have completed Courses 1, 2, 5 and 6. Three hours a week during one term.

ART.

MR. STUTTERD.
MR. POWELL.

1, 2, 3. FREE-HAND DRAWING. These courses are purely individual, and are varied to meet the needs of the line of work

the student is pursuing. Required of first year students in the Agricultural and College Preparatory courses, of second year students in the Manual Training Course in Mechanic Arts, and, during the first term, of third year students in the Domestic Science course. Five hours a week throughout the year. Two hours credit. Each course subdivides into the following parts:

(a) *Elementary Drawing.* This work includes drawing with charcoal, pencil, or pen and ink, in outline, mass, or light and shade, from simple objects, casts, flowers, plants, birds, animals, etc. Study of the simple principles of light and shade, proportion, perspective—both linear and aerial—texture, color, etc.

(b) *Advanced Drawing.* This includes the same principles applied to higher forms. Drawing from casts of the full length figure; sketching from nature—human, animal and landscape. The Agricultural students draw from the different breeds of livestock. Painting in water color or pastel from objects, flowers, plants, birds, animals, etc.

(c) *Design. The Applied Arts.* Principles of art in everyday things. Study of the composition of line, tone, and color applied to products of the different crafts, as tiles, pottery ware, textiles, ceramics, wall-paper, mosaics, bookcovers, etc. Planning and development of original motives and patterns by the students. Creating decorative forms from geometrical figures; selecting, conventionalizing and arranging flowers, birds, animals, and the human figure. Study of historic design. The Domestic Science students do designing for lace work, embroideries, rugs, tablecloths, etc.; the principles of art applied to household decoration. Mechanical Arts students make designs for carved wood, wrought iron, stained glass, etc.

4. ILLUSTRATING. Magazine, newspaper and commercial illustrating. This includes pen and ink drawings, wash drawings for half tones, water colors and oils, crayon drawings, lettering, show card writing, designs, titles, numbers, book plates, caricatures, and cartoons.

5 (a) *Composition.* Study of the composition ot line, tone,

and color applied to architecture, sculpture and painting. Original compositions by the students, using as motives, objects, flowers, plants, birds, animals, human figures, and landscape forms. Study of the work of the masters, with consideration given to conception and execution.

(b) SPECIAL WORK IN ART. Open to those who have taken a general course and wish to follow some particular line. This includes drawing in all mediums; modeling; painting in oil, water color, and pastel; designing and composition, in their different branches. Five hours a week throughout the year.

LIBRARY WORK.

MISS SMITH.

The subject includes the study of general reference books, such as encyclopedias, dictionaries, atlases, cyclopedias of special subjects, indexes to periodicals and general literature, handbooks of information and public documents. Talks will be given on classification and cataloguing of the books in the library, explaining their arrangement on the shelves and the use of the card catalogue. Practical questions will be given to the students to be looked up in the reference books. The object of the course is to familiarize the student with the library and to teach him how to obtain information quickly. Required of freshmen in the General Science Course. Elective to others. One hour a week throughout the year.

GEOGRAPHY.

PROFESSOR ROBINSON.

To get an intelligent conception of the natural resources of countries, the physical features receive special attention. Astronomical and geological features are presented as far as the course will permit. The principal changes that have wrought the present conditions are studied, and the atmosphere and water receive attention. Map drawing and frequent reviews are features of the course. Commerce in its effect upon nations is considered, as are also the classifications of mankind, animals, and plants. Required of students not graduated from the district schools, who are admitted to the Manual Training Courses. Three hours a week throughout the year.

MUSIC.

PROFESSOR THATCHER.
MRS. SLOAN.
MR. FOGELBERG.
MR. SMITH.
MRS. LINNARTZ.

The following courses in music are arranged with the two-fold idea of laying a sure foundation for professional work along any of the lines of the delightful art, and to fit the student for the proper application and fullest enjoyment of the beautiful classic compositions of famous composers. Theory of music as exemplified in the study of harmony, counterpoint and musical form, will be considered, and as far as possible, urged upon the student in both vocal and instrumental departments. Ensemble work may be had in the quartette, choir, band, and orchestra organizations, all of which have been successfully conducted during the past year. These advantages, together with those furn-

ished by free concerts and recitals, constitute the strongest features of a Conservatory course and will be open to any and all students of the College.

A certificate of graduation will be given upon the completion of any of the following courses:

FOUR YEAR PIANO COURSE. Completion of regular four years' work as prescribed, together with one year of vocal and one year of harmony.

FOUR YEAR VOCAL COURSE. Completion of four years' regular prescribed work, together with two years of piano and one year of harmony.

FOUR YEAR VIOLIN OR VIOLONCELLO COURSE. Completion of four years' regular prescribed work, together with two years of piano and one year of harmony.

FOUR YEAR COMPOSITION COURSE. Regular prescribed work, together with three years on piano, violin, cello, or cornet.

VOICE CULTURE AND ART OF SINGING.

FIRST YEAR. *Breathing*, study of vowel forms, elementary vocalization, easy songs.

SECOND YEAR. Vocalization, solfegio songs.

THIRD YEAR. Vocal studies, songs, arias, solo parts in easy operas, first year harmony, piano.

FOURTH YEAR. Advanced studies, English classic songs, German and Italian songs, arias, piano, etc.

PIANOFORTE.

FIRST YEAR. Position, hand culture, rhythm, scales, elementary week from Gurlitt, Beyer, Czerny and others.

SECOND YEAR. Easy studies and sonatinas by Bertini, Clementi, Kuhlau, Kohler, Loeschorn, easy pieces.

THIRD YEAR. Studies by Czerny, Dorn, Hiller, Gobbaert,

and Craemer, Sonatas by Mozart, Haydn and others; first year voice and singing.

FOURTH YEAR. Studies by Craemer, Kessler, Clementi, Gradus and Parnassum, solo pieces by Schubert, Mendelssohn, Chopin, Raff and others; first year harmony.

ORGAN.

FIRST YEAR. A standard method, and easy studies and pieces.

SECOND YEAR. Parallels piano course; carefully selected pieces suitable for the organ.

VIOLIN.

FIRST YEAR. Part of Henning's method for violin; little solos and duets.

SECOND YEAR. Balance of Henning's method; studies by Kayser; easy solos and duets; orchestra practice, first year piano.

THIRD YEAR. Studies by Kayser and Fiorilli, more advanced pieces; orchestra; second year piano.

FOURTH YEAR. Balance studies by Fiorilli, together with Kreutzer method; advanced solos; and first year harmony.

VIOLONCELLO.

FIRST YEAR. Part of Kummer's method for Violoncello with easy pieces.

SECOND YEAR. Balance of Kummer's method; easy studies by Dotzauer; easy pieces; orchestra practice, first year piano.

THIRD YEAR. Studies by Dotzauer; pieces moderately difficult, cello parts to easy trios and quartettes; orchestra, second year piano.

FOURTH YEAR. Balance of studies by Dotzauer; pieces of more advanced grades; cello parts to trios, quartettes, etc.; orchestra, harmony.

CORNET AND OTHER BRASS INSTRUMENTS.

The course of study for these various instruments corresponds in general with that for string instruments.

MANDOLIN AND GUITAR.

FIRST TWO TERMS of ten weeks each: first, second and third positions; part of a standard method, and easy pieces.

LAST TWO TERMS. Balance of method; more advanced work and ensemble playing.

HARMONY AND COMPOSITION.

FIRST YEAR. Text "Tone Relations," Goetschius; first year of piano or other solo instruments.

SECOND YEAR. Advanced harmony; simple counterpoint; melody writing; second year piano, violin, etc.

THIRD YEAR. Counterpoint; smaller forms; vocal and instrumental; third year piano, violin, etc.

FOURTH YEEAR. Large forms: instrumentation.

CHOIR AND GLEE CLUBS.

Time devoted to practice: five hours a week for Choir; two hours a week for Glee Clubs; either counting towards graduation.

BAND AND ORCHESTRA.

Five hours a week will be devoted to this work, counting towards garduation.

In addition to the foregoing, a "Choir Leader's Class" will be conducted by Director Thatcher, and (presupposing a fair knowledge of notation, keys, and intervals) will embrace the following: tone production as applied to the human voice, breathing, arrangement of choir, balance of parts, elements of time beating, reading and interpretation of small scores, and practices.

TUITION.

(No entrance fee will be charged special students in music)
For Term of Fifteen Weeks—Payable in Advance.

VOICE.

First Year. Class of three, one lesson a week	$ 7.50
Second Year and Advanced. (Private Instruction),	
One lesson a week	15.00
Two lessons a week	20.00

PIANO.

First Year. Class of three; one lesson a week	$ 7.50
Second Year. Class of three; one lesson a week	10.00
Advanced. Private instruction; one lesson a week	15.00
Advanced. Private instruction; two lessons a week	20.00

ORGAN.

First Year. Private instruction; one lesson a week	$ 7.50
Second Year. Private instruction; one lesson a week	10.00

VIOLIN.

First Year. Class of three; one lesson a week	$ 7.50
Second Year and Advanced. Private instruction; one lesson a week	15.00
Second Year and Advanced. Private instruction; two lessons a week	20.00

VIOLONCELLO.

Class Lessons. One lesson a week	$ 7.50
Private Instruction. One lesson a week	10.00

CORNET AND BAND INSTRUMENTS.

Class Lesson. One lesson a week	$ 7.50
Private Instruction. One lesson a week	10.00

MANDOLIN AND GUITAR.

One lesson a week	$ 7.50
Two lessons a week	10.00

HARMONY.

Class of four; one lesson a week	$ 7.50
Class of five; two lessons a week	10.00

CHOIR LEADER'S CLASS.

Two lessons a week	$ 7.50

MILITARY SCIENCE AND TACTICS.

COMMANDANT—CAPTAIN—U. S. ARMY.

COMMISSIONED OFFICERS FOR 1905-6.

Captains—F. R. Jenson, R. C. Hillman and M. J. Connelly.

First Lieutenants—E. E. Munk (Adjutant), C. E. Fleming (Quartermaster), W. J. Conger and W. Booker Preston.

Second Lieutenants—S. H. Rich and L. M. Winsor.

Sergeant Major—W. L. Jones.

All male students of the College, except those physically disabled, are required to take the prescribed work in the military department, which work may be completed in two years. The course consists of practical instruction in infantry drill, including the school of the soldier; company and battalion drill; target practice, for which the government makes an annual allowance of ammunition; instruction in first aid to the injured; practice marches; and a summer camp, modeled after the encampments held by the regular army and our National Guard.

Theoretical instruction by recitations and lectures is given on military subjects during the winter term, according to regulations issued by the War Department. The government furnishes rifles for infantry drill and two three-inch cannons for artillery instruc-

tion. A uniform, consisting of cap, dark blue blouse and trousers, and white gloves, must be worn by the cadets. Arrangements have been made by which this uniform can be obtained through the Secretary of the College at actual cost, about fifteen dollars. Cadets are required to wear the prescribed uniform when at drill or when receiving any military instruction. The uniform may be worn when not on military duty, provided no part of civilian dress is worn with it. This regulation applies to all students of the College, whether enrolled in the Military Department or not. The attention of students intending to enter college is called to the fact that this uniform has been found more serviceable than civilian clothes of the same price, and that all students must be prepared to order the uniform when they enter.

Regular drill and instruction occurs five hours a week. That the benefit derived from this course is appreciated today more than ever is shown by the fact that nearly a hundred of our higher institutions of learning throughout the country have military departments in charge of an officer of the regular army.

PHYSICAL EDUCATION.

Professor Campbell.
Miss Moench.

It is the aim of the Department of Physical Education to foster hygienic habits among the students, and to direct their exercise that they may have a physical development fit to support and make efficient the mental development which they seek in attending the institution. This is accomplished, first, by giving them the needed opportunity for gymnastic exercises; second, by encouraging athletic games, thereby stimulating an interest in their physical efficiency and in the pleasure of physical activity; and, third, by giving them a guiding knowledge of the principles of physical education. All the work is based upon a careful physical examination and strength test.

PHYSICAL EDUCATION FOR MEN.

1. Open to all male students of the institution. Three hours a week. One hour credit.

(a) GYMNASIUM EXERCISES. These consist of vigorous drills with dumb bells, Indian clubs, wands, etc., and gymnasium games under the supervision of the instructor.

(b) LECTURES. The gymnasium work is supplemented by lectures on personal hygiene, the physiology of exercise, first aid to the injured, etc.

PHYSICAL EDUCATION FOR WOMEN.

Two years of physical education is required of all women students of the College. The work of the courses is arranged, as far as possible, with reference to the needs of the individual student as indicated by the physical examination and study of personal tendencies. The hygienic, corrective, and educative effects of exercise are sought in the arrangement of movements.

Students are required to wear full gymnasium costume, consisting of blouse, divided skirt and slippers. Costumes are ordered through the Secretary of the College and furnished to the student at actual cost, which is about $3.

FIRST YEAR COURSE. The aim of this course is to overcome physical defects, to establish a correct carriage of the body, to strengthen the muscles, and to relieve the tension of brain work. The course consists of relaxing exercises, mat exercises, corrective movements, adapted from the German and Swedish systems, exercises with light apparatus, marching, dancing, and games.

SECOND YEAR COURSE. A continuation of the first year course. The variety of movements is increased according to the ability and progress of the student. Prescribed individual exercises with the developing appliances, athletics, etc.

Winter Courses.

AGRICULTURE.

1. AGRONOMY. This course will embrace a discussion of the following topics: the atmosphere as a source of plant food; the soil—its formation and classification, the compounds it contains as sources of plant food; the plant—how it grows, feeds, and matures, and the animal food product it yields; how to maintain the fertility of Utah soils; rotation of crops; irrigation in its relation to the production of crops. Five hours a week.

2. JUDGING AND MANAGEMENT OF LIVESTOCK. A discussion of the various types of livestock; their adaptability for various purposes on the farm, and the principles involved in their improvement. As much time as possible is given to the practical handling and judging of the living animals on the College farm. Craig's *Judging Live Stock.* Five hours a week.

3. FEEDING LIVE STOCK. The principles underlying the successful feeding of live stock on the farm and the practical applications of Utah conditions. Jordan's *Feeding Animals.* Five hours a week.

4. DAIRYING. A discussion of the composition and properties of milk; milk testing; milk fermentation, etc. The manufacture of butter and cheese is fully explained. Wing's *Milk and Its Products.* Five hours a week.

5. DAIRY PRACTICE. Those who wish to specialize in dairying have opportunity for ample practice in the College dairy, which is well equipped with modern apparatus.

6. Poultry. The instruction covers breeds of poultry, foods and feeding, buildings and management. Where desired, arrangements can be made for practice in operating incubators. Five hours a week.

7. Horticulture. The subject of horticulture is treated in a course of lectures covering the following subjects: selection of varieties; soil adaptation; preparation for planting; care and cultivation; commercial orcharding; picking, packing, and marketing fruit; orchard disinfection, including a careful study of prevalent orchard diseases and injurious insects, and the means of combating them; pruning of trees and treatment of tree wounds, to be demonstrated by practical work in the College orchard; top-grafting of mature trees; orchard irrigation and conservation of moisture; drainage of orchard lands; fertilization of trees for growth and for fruit, etc. Five hours a week.

8. Economic Entomology. This course is designed as an introduction to the more advanced work in entomology. In addition to the lectures and text-book work, students receive some training in the use of the microscope. Special attention is given to the general principles involved in dealing with injurious insects. Five hours a week.

9. Veterinary Science. Instruction is given on how to locate and detect the more common ailments of our domestic animals, and methods of prevention and curing are discussed. Those diseases most frequently met with in this inter-mountain region receive special attention. Consideration is given to ideal sanitary conditions for different animals; and common errors are pointed out and corrections suggested. Students taking this course are expected to attend the clinic each Monday. Five hours a week.

10. Irrigation and Drainage. This course is designed especially for the requirements of the farmer who can spend but a limited time in the school room. The work in irrigation includes

methods of irrigation, division and measurement of water, prevention of loss of soil moisture by evaporation and seepage, and some effects of irrigation upon plant growth and crop production. A few lectures will be given on methods of draining water-logged and alkali lands, with a discussion of the cost and results of under-drainage. Five hours a week.

11. FARM ACCOUNTING. The importance and necessity of keeping accounts on the farm are emphasized. Methods are discussed and developed. Business forms and customs are studied, and after the underlying principles have been mastered, practical work in accounting is given. Five hours a week.

DOMESTIC SCIENCE AND ARTS.

1. COOKING LECTURES. Preceding the cooking practice, one lecture is given each day. These lectures treat of the composition of foods and the general chemistry of cooking; rules for measuring and mixing; best methods of baking and boiling; deep and shallow frying; marketing and the selection of food; carving and serving food. The study of bills of fare, nutritive value of different foods, and of foods that are appropriately served together, is included in this course. The regular time allowed each class for practice is two two-hour periods a week. Special arrangements will be made, however, for those who wish to devote more time to this course; also for those who wish to perfect themselves in any particular line of cooking. Five hours a week.

2. COOKING PRACTICE. This course includes practice in all kinds of plain and pastry cooking, and some fancy cooking and confectionery making. Demonstration lessons are given on breakfast breads and hot cakes; croquettes of various kinds; dressing for fowls; boning, skewering, and larding meats; braizing, roasting, broiling, and other methods of cooking meats; the preparation of soups, sauces, salads, and salad dressing, together with

other subjects difficult of treatment in class practice. A three course lunch is served daily throughout the term by the members of the cooking classes. The young ladies take turns in presiding at the table as hostess, and also in waiting upon the table. The skill and confidence that they acquire by this practice, is of great value to them. Four hours a week.

3. HYGIENE. Lectures are given on the sanitary conditions best for the home; the danger from damp and unclean cellars; foul drains and sinks; the necessity for pure air and sunlight in the house. Talks are given on diet; regularity of habits; the necessity for a regular and sufficient amount of sleep; the care of personal health; home nursing and hospital methods. There are illustrative lessons on changing beds for the sick. Three hours a week.

4. DAIRYING. Instruction in cheese and butter-making, on both the factory and home dairy plans, is given in the College dairy. For lectures and plan of work, see Agricultural Courses.

5. SEWING. This course includes hand and machine sewing, the students completing as much of the work outlined in Courses 1 and 2 in Sewing as they can do successfully in the time allowed for the work.

6. DRESSMAKING. Gowns are cut out, basted and made entirely by the students. Students furnish material and make their own garments. Five hours a week.

7. DESIGNING, CUTTING AND FITTING. Instruction is given by talks on grace in design of costumes and harmony of colors. Special attention is given to hygienic modes of dress. The students are taught to make drawings of the costumes they design; they also learn to draft patterns from measurements. Further practice is given in cutting and fitting. Five hours a week.

8. FANCY WORK. This course includes Kensington embroidery, Roman cut work, Spanish laid work, drawn work, jeweled embroidery, and modern lace making. Five hours a week.

MECHANIC ARTS.

1. CARPENTRY A. Rudimentary exercises in sawing, ripping, planing, mortising, dovetailing, and joinery, furnish the details of this course. Correct methods of using and handling tools are emphasized. Fifteen hours a week.

2. CARPENTRY B. Sharpening and adjusting carpenter's tools, and saw filing, followed by simple cabinet work, constitutes the work of this course. Fifteen hours a week.

3. CARPENTRY C. This course consists of work in elementary cabinet making. School tables, bookcases, etc., are representative exercises. Open to students who have completed Courses A and B or their equivalent.

4. FORGING A. This course consists of preliminary exercises, such as drawing, bending, twisting, and shaping, and welding and making iron tools. Accuracy in methods and results is insisted upon. Fifteen hours a week.

5. FORGING B. The work of this course consists of practice in steel and iron welds, steel and steel welds, and general work in steel tool forging and dressing. Chisels, punches, reamers, hammers, tin shears, nippers, etc., are sample exercises. Prerequisite, Forging A. Fifteen hours a week.

6. FORGING C. This course consists of horseshoeing, carriage and farm implement repairing. Open to students who have completed Forging A and B or their equivalent.

COMMERCE.

1. BOOKKEEPING. An elementary course in the principles of accounting by single and double entry. Drill in commercial arithmetic, penmanship, business customs, etc. For further description

see Accounting 2, of which this is a modified course. Ten hours a week.

2. BUSINESS FORMS. The fundamental principles of accounting are applied in this course by means of practical work in the use of different forms and blanks pertaining to actual business. Given in connection with Accounting 1. Five hours a week.

3. COMMERCIAL LAW. A study of the nature of law, common and statutory law, contracts, agency, bailments, bankruptcy and insolvency, insurance, negotiable papers, partnerships, corporations, etc. Two lectures a week.

4. PENMANSHIP. See Penmanship 2.

THE SUMMER SCHOOL.

The College maintains, as an integral part of its work, a summer session, beginning on the first Monday following Commencement Day, and continuing for five weeks. Every department of the College is represented, the courses of instruction being arranged to meet the peculiar needs of summer students. For the benefit of teachers, special courses are provided in pedagogy, psychology, sloyd, and nature study, in addition to the regular work in Agriculture, Domestic Science, etc. College students desiring to make up conditions or prepare for advanced work are given all assistance possible. The entire equipment of the institution is available for the summer session, and every care is taken to preserve the standard and the spirit of the College. No admission requirements are prescribed, but students in all departments are directed by instructors to those courses in which they may pursue work to the best advantage. No one is advised to elect more than four courses. Students will receive such credits on the College register as the quality and amount of work done may warrant. Arrangements have been made with County Superintendents

throughout the State to accept summer school credits in individual subjects in lieu of examination. In addition to the routine work of the session, a course of daily lectures is provided, appealing both to teachers and to the general public, and covering a wide range of interesting subjects. An entrance fee of $2.50 is charged for each course for which the student registers. Board and rooms can be secured throughout the city at the usual prices, and the College Dormitory also is open to summer students at a nominal rate.

Alumni Association.

The Alumni Association was organized in June, 1899. All those who hold degrees in any of the courses of the College are eligible to membership. In the first two classes, three students were graduated with the degree of Bachelor of Civil Engineering (B. C. E.). Since 1895, five prescribed courses have been offered, but the degree in each has been Bachelor of Science (B. S.), the particular course being specified in the diploma.

Officers for 1906-7.

Charles W. Porter, '05, President.
John L. Coburn, '05, First Vice-President.
May Maughan, '03, Second Vice-President.
William Jardine, '04, Secretary.
Blanche E. Caine, '05, Treasurer.

Thirteenth Annual Commencement.

WITH DEGREES.

Bachelor of Science in Domestic Science.—Minnie Peterson, Logan, Utah.

Bachelor of Science in Commerce.—Mildred Forgeon, Logan, Utah.

Bachelor of Science in Civil Engineering.—Irvin Allred, Spring City, Utah.

WITH CERTIFICATES.

Agriculture.—Edgar Cook McCarty, Monroe, Utah. Cyril Veliko Petranoff, Omaha, Nebraska. William Richard Smith, Logan, Utah.

Domestic Science.—Esther Christensen, Newton, Utah. Letitia Flint, Layton, Utah. Vesta Kerr, Logan, Utah. Caroline Armeda McAlister, Logan, Utah. Rebecca Langton Ormsby, Rexburg, Idaho.

Commerce.—Joseph Sprague Bell, Park City, Utah. Alva Hansen, American Fork, Utah. John Emil Olson, Logan, Utah. Alfred David Skeen, Plain City, Utah. Charles James Sorenson, Hyrum, Utah. Cadmus Wallace, Sugar City, Idaho.

Manual Training Domestic Arts.—Alice Crookston, Greenville, Utah. Lena Hoffman, Logan, Utah. Eliza Jenson, Logan, Utah. Bertha Lowe, Franklin, Idaho. Ina Rosetta Stratford, Logan, Utah.

Manual Training Mechanic Arts.—Samuel Roy Egbert, Logan, Utah. Aaron Newey, Logan, Utah.

CATALOGUE OF STUDENTS.

In the following list A. stands for Agriculture; C., for Commerce; D. S., for Domestic Science; E., for Engineering; G. S., for General Science; M., for Music; M. A., for Mechanic Arts.

GRADUATES.

Bowman, Verna Pearl .... Ogden
Caine, Blanche Elise .... Logan
Coburn, John Leatham .... Wellsville
Farr, Eva .... Ogden
Greaves, Joseph Eames .... Preston, Ida.
Holmgren, Amanda .... Logan
Jardine, James Tertius .... Logan
Peterson, Elmer George .... Baker City, Oregon
Porter, Charles Walter .... Morgan
Rudolph, Mary Edith .... Taneytown, Maryland
Rudolph, Roy Everett .... Taneytown, Maryland

SENIORS.

Allred, Irvin (E.) .... Spring City
Forgeon, Mildred (C.) .... Logan
Peterson, Minne (D. S.) .... Logan

JUNIORS.

Gleed, Henry, Jr. (C.) .... Lima, Montana
Kearns, James Leonard (C.) .... Park City
Lee, Stuart (A.) .... Idaho Falls, Ida.
Mathews, Fred (A.) .... Eureka
Moench, Frank Moses (E.) .... Ogden
Olson, Aaron Brigham (C.) .... Logan
Peterson, Preston Geddes (A.) .... Baker City, Oregon
Powell, Inez (D. S.) .... Logan
Riter, Benjamin Franklin (C.) .... Logan

SOPHOMORES.

Austin, Torrey Lynn (E.) .... Liberty, Ida.
Barrows, Harry Percy (A.) .... Ogden
Beck, Wilford Williams (E.) .... Newton
Carver, Heber (E.) .... Ogden
Chambers, Edward (E) .... Smithfield
Dee, Florence Emily (D. S.) .... Ogden
Evans, Sarah (D. S.) .... Malad, Ida.
Farrell, Francis David (A.) .... Logan
Fenn, Ray Randolph (E.) .... Provo
Fleming, Charles Elliott (A..) .... Logan
Fonnesbeck, Leon (G. S.) .... Logan
Gardner, Wilford Woodruff (E.) .... Afton, Wyoming
Gentry, Ralph (E.) .... Coalville
Hansen, Alva (C.) .... American Fork
Hayball, Nellie (G. S.) .... Logan
Hillman, Robert Cown (C.) .... Oxford, Ida.
Homer, Russell King (G. S.) .... Logan
Horton, John Raymond (G. S.) .... Ogden
Hudman, Ellis (E.) .... Slaterville
Hunter, Joseph Greenwood (E.) .... American Fork
Jacobson, Eunice Estella (G. S.) .... Logan
Jensen, Fred Russell (C.) .... Manti
Jensen, Hans Ephraim (C.) .... Ephraim
Newey, Aaron (E.) .... Logan
Orr, Richard Robert (E.) .... Clover
Palmer, Alfred Merle (G. S.) .... Oxford, Ida.
Smith, William Richard (A.) .... Logan
Sorenson, Charles James (C.) .... Hyrum
Turpin, George Melvin (A.) .... Murray
Wallace, Cadmus (C.) .... Sugar City, Ida.

FRESHMEN.

Abbott, George (E.) .... Farmington
Ball, Wilbur Mansfield (A.) .... Trent, South Dakota

Beard, Charles Edward (A.)........Milford
Bjerregaard, Walter (E.)........Ephraim
Brown, Mark (E.)........Ogden
Burns, Annie Ethelyn (D. S.)........Logan
Cardon, Phillip Vincent (G. S.)........Logan
Christiansen, Peter Victor (E.)........Hyrum
Cole, George W. (E.)........Paris, Ida.
Connelley, Mathias Joseph (A.)........Park City
Dobbs, Lester Reese (E.)........Bingham
Eccles, Bertha O. (D. S.)........Ogden
Farnsworth, William Yates (E.)........Frisco
Flint, Letitia (D. S.)........Layton
Gardner, George (A.)........Pine Valley
Groesbeck, Josephine (D. S.)........Logan
Hansen, Orson Wilford (G. S.)........Logan
Hanson, Robert Hammond (A.)........Levan
Harris, Melvin Charles (G. S.)........Richmond
Hoff, Ernest Prior (G. S.)........Georgetown, Ida.
Homer, Mell (D. S.)........Logan
Hughes, Robert (E.)........Samaria, Ida.
Jacobson, Julius W. B. (A.)........Logan
Jenson, Mildred Leona (D. S.)........Brigham
Kerr, Vesta (D. S.)........Logan
Lee, William Henry (A.)........Idaho Falls, Ida.
Madsen, Howard Peter (E.)........Manti
Mathias, Jared Leroy (E.)........Rigby, Ida.
McAlister, Caroline Armeda (D. S.)........Logan
Nebeker, Ruby Leith (C.)........Logan
Nelson, Swen Ezekiel (A.)........Newton
Ormsby, Rebecca Langton (D. S.)........Rexburg, Ida.
Parry, Eston Marvel (A.)........Salt Lake City
Peterson, Elizabeth (D. S.)........Logan
Pond, Hazel (D. S.)........Salt Lake City
Preston, William Booker (E.)........Logan
Simmering, Meint Fred (A.)........Hastings, Neb.
Smith, Effie Eliza (D. S.)........Logan

Stoops, Herbert Morton (G. S.) ———— Logan
Taylor, Thomas Gabriel (E.) ———— Far West
Thomas, William Henry (G. S.) ———— Malad, Ida.
Walker, William Lawrence (E.) ———— Eden
Walters, Edward Haslam (G. S.) ———— Logan
Wendleboe, Leo Paul (E.) ———— Logan
Wheeler, Jerome (A.) ———— Slaterville
Wright, John Franklin (A.) ———— Nephi

SPECIALS.

Bexell, Mrs Dena (C.) ———— Logan
Blair, Samuel (G. S.) ———— Lewiston
Boothe, Louis Hyrum (M.) ———— St. Charles, Ida.
Cameron, Isabelle (M.) ———— Carey, Ida.
Crockett, Henry Wallace (A.) ———— Logan
Crockett, John Alvin (A.) ———— Logan
Dahle, Ernest Edwin (G. S.) ———— Logan
Dahle, Norman Edward (G. S.) ———— Logan
Davis, Mary V. (G. S.) ———— Logan
Egbert, Maude (C.) ———— Logan
Eliason, Nora (M.) ———— Logan
Gardner, Josephine (M.) ———— Pine Valley
Gilpin, Grace (C.) ———— Corinne
Gray, Clyde Martinus (M.) ———— Pocatello, Ida.
Greenhalgh, Mable (M.) ———— Logan
Hirst, Charles Terry (G. S.) ———— Logan
Izatt, Catherine (D. S.) ———— Logan
Jones, Ricy Howell (C) ———— Logan
Linnartz, Mrs. L. E. (M.) ———— Logan
McCracker, Henry (G. S.) ———— Smithfield
McKay, Thomas Evans (A.) ———— Ogden
Ostien, Mrs. Julie Winge (G. S.) ———— Logan
Peterson, Mattie Othelio (G. S.) ———— Logan
Peterson, Wallborg (M.) ———— Logan
Porter, Mrs. Alberta (G. S.) ———— Logan
Powell, Mrs. Mada (D. S.) ———— Logan

Robinson, Mrs. E. W. (C.) ..... Logan
Robinson, Frank Griffin (G. S.) ..... Richmond
Skeen, Electa (M.) ..... Plain City
Smith, Harriett (G. S.) ..... Logan
Smith, Joseph A., Jr. (M.) ..... Providence
Snow, Willard Conrad (G. S.) ..... Ogden
Styer, Mrs. Bessie Wilkes (G. S.) ..... Logan

AGRICULTURE.

Third Year.

McCarty, Edgar Cook ..... Monroe
Petranoff, Cyril Veliko ..... Omaha, Neb.

Second Year.

Barker, Joseph Delbert ..... Ogden
Barton, George Franklin ..... Ferron
Benson, John Phineus ..... Newton
Brown, William Wallace ..... Liberty, Ida.
Burton, Ephraim Fielding ..... Afton, Wyo.
Burton, Wilford Fielding ..... Afton, Wyo.
Caine, Lawrence Ballif ..... Logan
Christensen, David Wilford ..... Newton
Fonnesbeck, Victor Christian ..... Logan
Hagan, Harold Raymond ..... Salt Lake City
Hansen, Daniel Nephi ..... Brigham
Hermanson, Christian, Jr. ..... Elsinore
Kjar, Lewis Melroy ..... Manti
Murdock, David Stacy ..... Heber
Pearson, Joseph Harry ..... Moore, Ida.
Peterson, Christian A. ..... Newton
Peterson, Erastus ..... Glenwood
Rigby, George Ora ..... Newton
Smith, George A. ..... Poplar, Ida.
Whitehead, Frank George ..... St. George
Woodbury, Warren Haskell ..... Granger
Wright, Thomas Lynn ..... Nephi

First Year.

Albrethsen, Adolph	Picabo, Ida.
Allen, Merle	Cove
Anderson, Arthur Ray	Moore, Ida.
Arthur, Evan B.	St. John
Austin, Clarence	Salt Lake City
Bangerter, Frederick Lorenzo	Granger
Batt, William	Logan
Benson, Willis	Newton
Brinkerhoff, George, Jr.	Thurber
Christensen, Ray	Gunnison
Clotworthy, Leonal	Heber
Cook, Junius Melvin	Ogden
Cox, Almer Burns	Fairview
Cox, George W.	Salt Lake City
Crafts, Elmer	Cedar Valley
Edwards, Leroy	Gunnison
Ellsworth, Preston Blair	Louisville, Ida.
Froerer, Frederick	Huntsville
Harris, Guy Frederick	Deweyville
Harris, William Zera	Richmond
Haskell, David Eligher	Newton
Hobson, Ivan Leslie	Logan
Hoggan, Alma John	Louisville, Ida.
Holden, James Almon	Colonia Diaz, Mexico
Homer, Brigham Ezra	Poplar, Ida.
Jackson, Victor Orin	Randolph
Johnson, Arthur	Kanab
Jones, William LeRoy M.	Mt. Sterling
Kartchner, Charles	Logan
Knighton, Lynn Kearns	Gunnison
Knighton, Ross Kearns	Gunnison
Martin, Julius Patric	Salt Lake City
Murdock, Alva Pierce	Heber
Peterson, Jesse L.	Mendon

Reese, Parley .... Brigham
Tippetts, John Ray .... Lake Shore
Tovey, George Chivers .... Malad, Ida.
Turpin, Leroy .... Murray
Wagstaff, John Alexander .... American Fork
Washburn, Thomas .... Monroe
West, Archie James .... Salt Lake City
Whitmore, Arthur Lawrence .... Price
Winsor, Anson Perry .... Enterprise
Winsor, Luther Murkins .... Enterprise

Winter Course.

Anderson, Nelson William .... Mt. Pleasant
Barton, Arthur G. .... Ferron
Butcher, Arthur George .... Kaysville
Fielding, Thomas A. .... Mancos, Colorado
Frew, Wallace .... Idaho Falls, Ida.
Livingston, Archie D. .... Manti
Martin, Francis Arthur .... Wilson
Martineau, Mrs. Emeline .... King
Martineau, Nephi .... King
Nielsen, Peter Agaard .... Salt Lake City
Olson, William Arthur .... Mt. Pleasant
Packer, Ira W. .... Corinne
Robins, Emmett .... Salina
Seeley, John Leo .... Mt. Pleasant
Wagstaff, William George .... Murray
Washburn, Orson Pratt .... Monroe

DOMESTIC SCIENCE.

Third Year.

Christensen, Esther .... Newton
Vibrans, Gertrude Marie .... Cokeville, Wyo.

Second Year.

Adams, Catherine Maria .... Layton
Barber, L'Aprile .... Cardston, Canada

Breeden, Fannie Marshall .... Salt Lake City
Cooper, Della .... Dempsey, Ida.
Farrell, Loraine .... Logan
Jones, Letitia .... Malad
Mathisen, Sophia E. .... Ovid, Ida.
Matthews, Ruby Ethel .... Logan
Nibley, Annie .... Logan
Roberts, Janie Caroline .... Layton
Smith, Frances .... Logan
Stoops, Josephine Curtis .... Logan

First Year.

Adams, Katie .... Layton
Cole, Zina Rachel .... Willard
Daniels, Anna .... Malad, Id.
Davidson, Nellie .... Greenville
Jones, Mame .... Logan
Jones, Sarah Cecelia .... Malad, Ida.
Justesen, Norma Fay .... Osceola, Nevada
Lund, Annie .... Logan
Mathisen, Anna .... Ovid, Ida.
Peck, Julia Ann .... Malad, Ida.
Reese, Lillian Cecelia .... Malad, Ida.
Roberts, Phebe .... Layton

COMMERCE.

Third Year.

Bell, Joseph Sprague .... Park City
Burnett, John Heath .... Darlington, Ida.
Judd, Robert Lund .... St. George
Olson, John Emil .... Logan
Pearson, Roy Curtis .... Moore, Ida.
Phillips, William .... Salina
Skeen, Alfred David .... Plain City
Whitmore, Junius Leo .... Price

Second Year.

Amussen, Victor Smith	Logan
Andrews, Michael, Jr.	Logan
Bennett, Leo.	Lago, Ida.
Bramwell, John	Plain City
Brown, Timothy Jerome	Annis, Ida.
Burns, John Harland	Manti
Christensen, Newell Arnold	Gunnison
Conlee, Grace Etta	Salmon, Ida.
Frank, Justus Ray	Logan
Gardner, Albert Thomas	American Fork
Hansen, John Egbert	Levan
Hasken, William Henry, Jr.	Wellsville
Henroid, Leonard Claudius	American Fork
Hicks, William John	Bingham
Johnson, Heber Francis	Richmond
Johnson, Henrietta	Oxford, Ida.
Jones, Bernard Amos	Malad, Ida.
Jones, Esdras Holegate	Kelton
Jones, Ricy Diderborg	Logan
Justesen, Virgis William	Logan
Kearl, Christopher James	Smithfield
Larson, Johanna	St. Charles, Ida.
Mattson, Millie Adina	St. Charles, Ida.
Munk, Elizabeth	Logan
Munk, Ernest Eugene	Manti
McGown, Joseph Clarence	Custer, Ida.
Nielsen, Loney	Logan
Olsen, Wilford Woodruff	Logan
Peterson, Willard Larson	Petersboro
Rich, Amoretta	Logan
Rich, Stanley Hunter	Turnpike, Ida.
Smith, Guy Marvin	Lewiston
Westerholm, Ludwig	Custer, Ida.
Whitmore, Lorin Alma	Nephi

First Year.

Adams, Delbert Hyrum	Layton
Andrews, Junius	Logan
Anhder, Eva Almanie	Hyrum
Ballif, John Lyman, Jr.	Rexburg, Ida.
Beaman, Eugene	Stockton
Belnap, Amos	Ogden
Bingham, Danford Leroy	Ogden
Birch, Herbert Ezra	Wellington
Call, Omer Mathew	Rigby, Ida.
Carpenter, Alfonso	Kamas
Carpenter, Martin	Kamas
Clark, Samuel Elias	St. Charles, Ida.
Ellison, Delbert	Layton
Flack, James Milton	Logan
Gibbs, Francis Parley	Portage
Greaves, Harley	Preston, Ida.
Gutting, Campton	Blackfoot, Ida.
Hanson, Erlese Peter	Providence
Hansen, Radie	Logan
Hatch, John	Vernal
Holmes, Alfred Hugh	Rock Springs, Wyoming
Jamison, William Flave	Lewiston
Jessen, Henry Wesley	Wellington
Johnson, David Ervin	Garden City
Justeson, Barney Traverse	Osceola, Nev.
Kellogg, Howard	Rock Springs, Wyo.
Lowe, Rosella	Franklin, Ida.
Lund, Lettie	Logan
Madsen, Ezra	Bear Lake, Ida.
Morgan, John Dever	Collingston
Morris, George William	Neeley, Ida.
Mortensen, John William	Levan
McBride, Warren Grover	Tooele
McCausland, Georgina Emily	Logan
Nelson, Jennett	Logan

Nichols, Earl .... Wallsburg
Outzen, Clarence Albert .... Richfield
Owens, Thomas Evan .... Malad, Ida.
Page, Cora .... Payson
Paxman, Burdell .... Silver
Peterson, Helga .... Mendon
Plant, Henry Thomas, Jr. .... Richmond
Pratt, Isabelle .... Blackfoot, Ida.
Preston, Fred .... American Fork
Roberts, William Robert .... Montpelier, Ida.
Smart, Melvin Shrives .... Salt Lake City
Sprouse, Nellie May .... Garden City
Swauger, Floyd .... Mackay, Ida.
Swauger, Frank .... Mackay, Ida.
Taylor, Vera Evelyn .... Baker City, Oregon
Thomas, Espy .... Malad, Ida.
Thomas, Seth .... Malad, Ida.
Wood, Jesse .... Fielding
Wright, Leslie .... Lago, Ida.

Winter Course.

Ball, Thomas Gladstone .... Wasatch
Baxter, Stephen Hopkins .... Wellsville
Colby, Legrand Collins .... Mendon
Coons, Thaddeus .... Heber
Jenkins, Ladell .... Parker, Ida.
Jensen, Alma .... Mantua
Mathisen, Alma .... Ovid, Ida.
Rasmussen, Henry .... Mantua
Richards, Frederick William .... Fielding
Rosenbaum, David Howell .... Brigham
Roundy, Lauren Shadrach .... Kanab
Tarbet, Willard .... Logan
Warr, Albert .... Kamas

DOMESTIC ARTS.

Fourth Year.

Crookston, Alice .... Greenville
Griffiths, Margaret .... Benson
Hoffman, Lena Martha .... Logan
Jenson, Eliza .... Logan
Lowe, Bertha .... Franklin, Ida.
Nebeker, Mabel .... Logan
Stratford, Ina Rosetta .... Logan

Third Year.

Barker, Nellie .... Ogden
Bybee, Sarah .... Lewiston
Christensen, Mrs. Alvaretta .... Hyde Park
Crookston, Jean .... Greenville
Johanson, Anna .... Littleton
McDonald, Katherine .... Salmon, Ida.
Smith, Gertrude .... Logan
South, Myrtle .... Salt Lake City

Second Year.

Adams, Ethel .... Logan
Alvord, Duella .... Ogden
Bronson, Lucy .... Ogden
Cheney, Blanche LeNore .... Laketown
Christensen, Cornelia .... Rockville
Daniels, Virginia .... Logan
Ellis, Kate .... Logan
Forgeon, Emily .... Logan
Frederickson, Emma .... Colonia Diaz, Mex.
Fuller, Annabelle .... Eden
Fuller, Ella Evelyn .... Eden
Harris, Mrs. Clara L. .... Deweyville
Homer, Edith .... Logan
Jensen, Sylvia .... Logan
Kennedy, Ethel May .... Randolph

Krebs, Emma .... Providence
Leigh, Jennie .... Cedar City
Mathews, Etta .... Eureka
Mathews, Margaret .... King
Mattson, Edith Dortho .... St. Charles, Ida.
Moench, Janie Elizabeth .... Logan
Nebeker, Eva Magdelane .... Logan
Nelson, Minnie Ann .... Thayne, Wyo.
Parke, Lavinna .... Riverside
Quayle, Blanche .... Dingle, Ida.
Rosenbaum, Myrtle .... LaGrand, Oregon
Skeen, Isabell .... Plain City
Stratford, Pearl .... Logan
Sullaway, Sara Vina .... Mt. Home, Ida.
Wright, Clara .... Franklin, Ida.
Wright, Ella .... Franklin, Ida.

First Year.

Adamson, Hilda .... American Fork
Greenhalgh, Cora Elma .... Logan
Laub, Phyllis .... Fielding
Mitchell, Learretta .... Logan
Nelson, Essie Jean .... Logan
Nowacki, Rose Ella .... Mackay, Ida.
Passey, Ada Elizabeth .... Paris, Ida.
Richards, Rena Luella .... Fielding
Robinson, Anna .... Richmond
Shepherd, Elizabeth Jane .... Kamas
Smith, Mary Œnone .... Salt Lake City
Smith, Priscilla .... Salt Lake City
Sprouse, Geneva .... Garden City
Wood, Emma .... Trenton

Winter Course.

Arthur, Emily Bennett .... St. John
Halquist, Mary .... Richmond
Hansen, Millie .... Logan

Holmes, Eleanor .... Wilson
Peterson, Mary .... Richmond

MECHANIC ARTS.

Fourth Year.

Egbert, Samuel Roy .... Logan
Passey, Edward John .... Paris, Ida.
Taylor, John .... Salt Lake City

Third Year.

Aldous, Alfred Evan .... West Weber
Aldous, Sidney Edgar .... Huntsville
Cain, John .... Eureka
Carter, Wesley James .... Deweyville
Frederickson, Alma .... Colonia Diaz, Mexico
Goff, Jedediah H. .... Logan
Leslie, Joseph Wilford .... Fountain Green
Mattson, George Bert .... Poplar, Ida.
Mitchell, Edgar Bentley .... Logan
McLeod, William F. .... Eureka
Olson, Charles Henry .... Crescent
Rowland, Thomas Greaves .... Logan
Sandgreen, George Edward .... Pleasant Grove
Wangsgaard, Fred Christian .... Huntsville

Second Year.

Anderson, William Sherman .... Moroni
Armitage, Herbert Stansfield .... Briston, Montana
Beck, Alma .... Spanish Fork
Burnett, George Randall .... Ogden
Chugg, Joseph Orley .... Ogden
Cole, LaMont .... Paris, Ida.
Crookston, Nicholas Lee .... Logan
Frew, William Amos, Jr. .... Hooper
Gleed, Edward Reese .... Lima, Montana
Hess, Seymour B. .... Fielding

Johnson, Hans Christian	Bancroft, Ida.
Johnson, Swen	Marysville, Ida.
Morley, Wilford Leroy	Moroni
Nebeker, Reuben Peter	Willard
Nelson, Nels John	St. Charles, Ida.
Olsen, Joseph William	Crescent
Passey, Parley Clifton	Paris, Ida.
Pratt, David Green	Blackfoot, Ida.
Pyle, Guy Everett	Opal, Wyoming
Randolph, William Franklin	Halleck, Nevada
Smith, Harl Burnham	Logan
Ware, Joseph William	Layton
Williams, John	Kamas

First Year.

Adams, Leo C.	Logan
Aikele, Andreas, Jr.	Providence
Allred, Alpin Looyde	Deseret
Anderson, Ernest Raymond	Moroni
Baker, Noah Chester	Mendon
Beus, Davis Herbert	Yost
Cameron, William Henry	Gold Butte, Mont.
Crockett, Vernon Winsor	Logan
Croft, Leffel Allen	Deseret
Cropper, Glenn	Deseret
Dahle, George Alfred	Logan
Eldredge, Roscoe	Coalville
Evans, Arthur Jay	St. John
Fackrell, Adelbert	Randolph
Ford, Lawrence	Wallsburg
Fraiser, James E.	Lamoille, Nev.
Izatt, George James	Logan
Jones, William Ennes	Beaver
Kearl, Lester C.	Smithfield
Laub, John	Fielding
Longstroth, Alma	Mendon

Moore, Arthur Harold .... Weston, Ida.
Murphy, Jacob Edward .... Salina
Nielson, Loren Andrew .... Sanford, Colorado
Outzen, Jesse Richard .... Richfield
Outzen, Martin William .... Richfield
Paddock, John Stephen .... Wisdom, Mont.
Patrick, John Hulet .... Springville
Peterson, Alfred Christian .... Mendon
Quinney, George .... Logan
Sneddon, James Yates .... Aguilar, Colorado
Stevens, Marion R. .... Holden
Styer, William Delp .... Logan
Swenson, Helga .... Pleasant Grove
Taylor, Jesse .... Loa
Taylor, Robert Allen .... Fremont
Turner, Simpson Montgomery .... Logan
Williams, Percy Julian .... Ophir

Winter Course.

Anderson, Frank .... Moroni
Beckstead, Alexander .... West Jordan
Bennett, Delbert .... Hooper
Blake, Fred .... Hooper
Bragger, Oliver .... Willard
Buchanan, Archibald Lester .... Venice
Cawley, Claude .... Wilson Lane
Cooper, Dwight Homer .... Dempsey, Ida.
Cox, Amasa Bruce .... Fairview
Dobbs, Lewis Harrison .... Bingham
Frew, Walter Scott .... Logan
Gilette, Lawrence Augustus .... Tooele
Hansen, Torbin .... Logan
Holmes, William .... Wilson
Janes, Royal .... Hyrum
Jorgensen, Wilford A. .... Logan
Nyberg, Victor .... Chester

Olsen, Wilford Benjamin .... Moroni
Patterson, Ray .... Hooper
Powell, Milton .... Logan
Randolph, Roy Wilford .... Halleck, Nev.
Rasmussen, Howard .... Chester
Richards, Arthur .... West Jordan
Smith, LeRoy .... Greenville
Stoddard, Walter Bert .... Hooper
Tibbitts, Edwin .... Providence
Warner, Frank John .... Parker, Ida.
Washburn, John E. .... Wales
Wells, Hugh .... Tilden, Ida.
Wright, Cyril James .... Franklin, Ida.

COLLEGE PREPARATORY.

Second Year.

Casto, William Henry, Jr. .... Custer, Ida.
Child, Linzy Clark .... Lima, Montana
Conger, Walter James .... Ogden
Daniels, Edward Earl .... Logan
Evans, David William .... Malad, Ida.
Finlayson, Vernon Alexander .... Logan
Grue, Joseph .... Plain City
Johnson, John William .... Marysville, Ida.
Jones, William Stark .... Brigham
Kerr, Ivin Earl .... Ora, Ida.
Kerr, Robert Mortimer .... Ora, Ida.
Kewley, Robert James .... Logan
Malm, John Siegfried .... Custer, Ida.
Mortimer, William .... Logan
McDonald, Alice Isabel .... Salmon, Ida.
Nebeker, Herbert John .... Logan
Nebeker, Shirley .... Logan
Peterson, Dean Freeman .... Scipio
Phelps, Oscar .... Mesa, Arizona
Peirce, Lisle Kenneth .... Brigham

Pond, Bertrand Thorne .... Lewiston
Preston, Alexander Pyper .... Logan
Riter, William Corlett .... Logan
Roberts, Loa E. .... Salt Lake City
Robinson, David Earl .... Logan
Stewart, James Haslam .... Logan
Stewart, Lynn D. .... Benjamin
Stewart, Robert Haslam .... Logan
Swenson, Dan Arthur .... Pleasant Grove
Thomas, Guy Leland .... Logan
Turner, Franklin David .... Logan
Wrigley, Robert Lacourn .... American Fork
Wyatt, Franklin A. .... Wellsville

COLLEGE PREPARATORY.

First Year.

Brown, Frank Martin .... Liberty, Ida.
Burbank, Sydney Raht .... Black Rock
Coburn, Elmo Preston .... Wellsville
Cole, Winslow Charles .... Willard
Dickson, Bartlett Davis .... Cowley, Wyoming
Dickson, James Barnard .... Rock Springs
Dunlop, Scott Barratt .... Logan
Egbert, Archie .... Logan
Egbert, Ivan .... Logan
Harris, Lester .... Beaver
Hartvigsen, Hyrum Jacob .... Downey, Ida.
Johnson, Fred Oscar .... Logan
Johnson, Mary Louise .... Logan
Knapp, Alma Johnston .... Moroni
Martineau, Vere Loraine .... Logan
Monsen, Lawrence Christian .... Richmond
Monsen, Miriam .... Malad, Ida.
Morgan, Francis Holmes .... Willard
McAlister, Clair H. H. .... Logan
Peterson, Charles O. .... Logan

Philbrick, Oliver Augustus .... Fossil, Oregon
Porter, Ralph Orlando .... Porterville
Smith, Wesley Ensign .... Logan
Spencer, Clara Jennett .... Porterville
Taylor, Phebe Estella .... Fremont
Tovey, James .... Malad, Ida.
Wondershek, Minnie .... Hailey, Ida.
Woolley, Vern Clark .... Grantsville

SUB-PREPARATORY.

Bowman, Albert Elijah .... Ogden
Brough, Lewis Roy .... Lyman, Wyo.
Caine, George Ballif .... Logan
Calhoun, William Albert .... Bellevue, Ida.
Chipman, Reed John .... Magrath, Canada
Cotant, George William .... Halleck, Nev.
Crane, William .... Draper
Davis, Alice Mae .... Coquelle, Oregon
Evans, Howard .... Garland
Gessel, Henry .... Logan
Grunder, John .... Logan
Hampton, Orlando .... Franklin, Ida.
Henderson, Adelbert .... Clifton, Ida.
Henderson, Marion .... Clifton, Ida.
Izatt, Angus .... Logan
Kerr, Leona .... Logan
Lofthouse, Charles Edwin .... Paradise
Lowe, Robert Downey .... Franklin, Ida.
Lundberg, Samuel Albert .... Logan
Mantey, Julius Robert .... Picabo, Ida.
Martensen, Alfred Alvin .... Mayfield
Murray, Joseph Woodward .... Wellsville
McNeil, William J. .... Logan
Newburger, John Joseph .... Logan
Ormond, William .... Logan
Parker, Henry George .... Rock Springs, Wyo.

Peterson, Ephraim John .... Logan
Sayer, John Henry .... Rigby, Ida.
Schweizer, Fred Christian .... Logan
Smith, William Geraint .... Providence
Sorenson, James William .... Mayfield
Sorenson, Thomas Peter .... Mayfield
Stonebraker, George W. .... Hoytsville
Tremelling, Claude Joseph .... St. Charles, Ida.
Williams, Abednego .... Kamas
Wittwer, Fred Samuel .... Davenport, Iowa

SPECIALS.

Ames, Luella (M.) .... Wellsville
Batt, Pearl (M.) .... Logan
Farr, Keith (M.) .... Logan
Hart, Leona Salina (M.) .... Logan
Maughan, Laura Haslam (M.) .... Wellsville
McAlister, Venna Harriett (M.) .... Logan
McCarty, Ruby (M.) .... Logan
Phelps, Mamie (M.) .... Mesa, Arizona
Shaw, Lela Anna (M.) .... Corinne

SUMMER SCHOOL.

Baker, Olive .... Mendon
Brown, Jennette .... Ogden
Chambers, Parley C. .... Smithfield
Flowers, William J. .... Standard, Ida.
Forgeon, Mildred .... Logan
Foster, Florence .... Las Cruces, New Mex.
Fryer, Lutie H. .... Santaquin
Gleason, Mary .... Pleasant Grove
Green, Margaret D. .... Layton
Griffiths, Elizabeth .... Benson
Griffiths, Margaret .... Benson
Hammond, Ivie Gertrude .... Millville
Hillyard, Inez Theresa .... Smithfield
Hobson, Gertrude .... Logan

Holladay, Mabel	Smithfield
Johnson, Harriett	Mesa, Arizona
Kerr, Vesta	Logan
Kewley, Nann	Logan
Larson, H. Christine	Mink Creek, Ida.
Maughan, Julia Annette	Logan
Maughan, Lavinia	Logan
Merrill, Alva Retta	Richmond
Miles, George Edwin	Smithfield
Montgomery, Priscilla	Ogden
Montierth, Caroline	Thatcher, Arizona
Peterson Hermes	Pleasant Grove
Peterson, Margaret	Hyrum
Powell, Inez	Logan
Roberts, Vida Margaret	Layton
Simonds, Lillian	Logan
Smith, George Young	Smithfield
Stuart, Stella Mae	Wardboro, Ida.
Telford, Mildred	Richmond
Thomas, Olga Elydia	Logan
Walters, Jane	Wellsville
Williamson, May	Wellsville

SUMMARY BY YEARS.

Graduates	11	
Seniors	3	
Juniors	9	
Sophomores	30	
Freshmen	46	
Specials (college)	33	
Fourth Year (with rank of Freshmen)	3	
Third Year (with rank of Freshmen)	12	
	—	147
Fourth Year	7	
Third Year	22	
Second Year	123	

First Year	162	
College Preparatory	61	
Sub-Prepartory	36	
Winter Course	64	
Optionals	9	
		484
Summer School		36
		667
Number of names repeated		4
Total registration		663

SUMMARY BY COURSES.

Agriculture	108
Domestic Science and Art	113
Commerce	127
Engineering and Mechanic Arts	136
General Science	30
Special	20
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Summer School	36
	667
Names repeated	4
Total registration	663

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